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WATER QUALITY OF LAKES IN THE SEVEN LINKS PLANNING AREA

PETERBOROUGH COUNTY

1979

PART 2

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Ontario
Ministry of the Environment

The Honourable
Harry C. Parrott, D.D.S.,
Minister

Graham W. S. Scott,
Deputy Minister

WATER QUALITY SURVEY OF LAKES

IN THE SEVEN LINKS PLANNING AREA

PETERBOROUGH COUNTY

PART 2

Field Survey 1978
Report 1979

Report Prepared by: Technical Support Section
Central Region

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BELMONT LAKE

Belmont Lake is located about 6 Km north east of the Village of Havelock in Belmont Township. The lake receives drainage from the North and Crowe Rivers and discharges to the Crowe River upstream of Crowe Lake. There were 24 permanent residences, 414 cottages, 19 rental units and 40 tent/trailer sites along the shoreline of the lake during 1978. A high flushing rate was noted for Belmont Lake of 10.29 for 1978.

Belmont Lake had moderately hard, slightly alkaline water with a moderate amount of colour. Water clarity as indicated by Secchi disc was good with a mean value at Station B4 of 4.1m. Based on Secchi disc values alone, Belmont Lake was considered moderately enriched.

Thermal stratification was noted at the three lake stations during the sampling period.

Dissolved oxygen distribution in the lake water column was clinograde (gradually decreasing within the bottom waters with depth) with a minimum bottom water concentration of 0.5 mg/l. The reduction in dissolved oxygen concentration was probably due to the decomposition of accumulating organic material and sediment oxygen demand. The rate of the oxygen depletion or the areal hypolimnetic oxygen demand (A.H.O.D.) was calculated as 306 mg/m^2 day. According to limits suggested by Mortimer (1941, 1942), the Lake was considered mesotrophic.

The mean total phosphorus concentration in the euphotic zone indicated that the lake was moderately enriched or mesotrophic. No significant accumulation of nutrients was noted in the bottom waters during the survey.

Phytoplankton densities were favorably low during the survey. The phytoplankton community was dominated by Cyanophyceae (blue green algae) and Bacillariophyceae (diatoms). Despite the low density, common species of phytoplankton present in the lake are commonly found in eutrophic waters. Aphanizomenon, the most common form, generally requires at least moderately enriched conditions to thrive. Although the phytoplankton present were in favorably low densities, some of the common forms such as Aphanizomenon and Anabaena cause undesireable water quality problems if nutrient concentrations are significantly increased. Based on phytoplankton density, the lake was considered oligotrophic or unenriched.

Crustacean zooplankton densities were relatively low and the community was dominated by Calonoida. This group normally dominates the open-waters of unenriched lakes. Based on zooplankton density and composition, Belmont Lake was considered unenriched or oligotrophic.

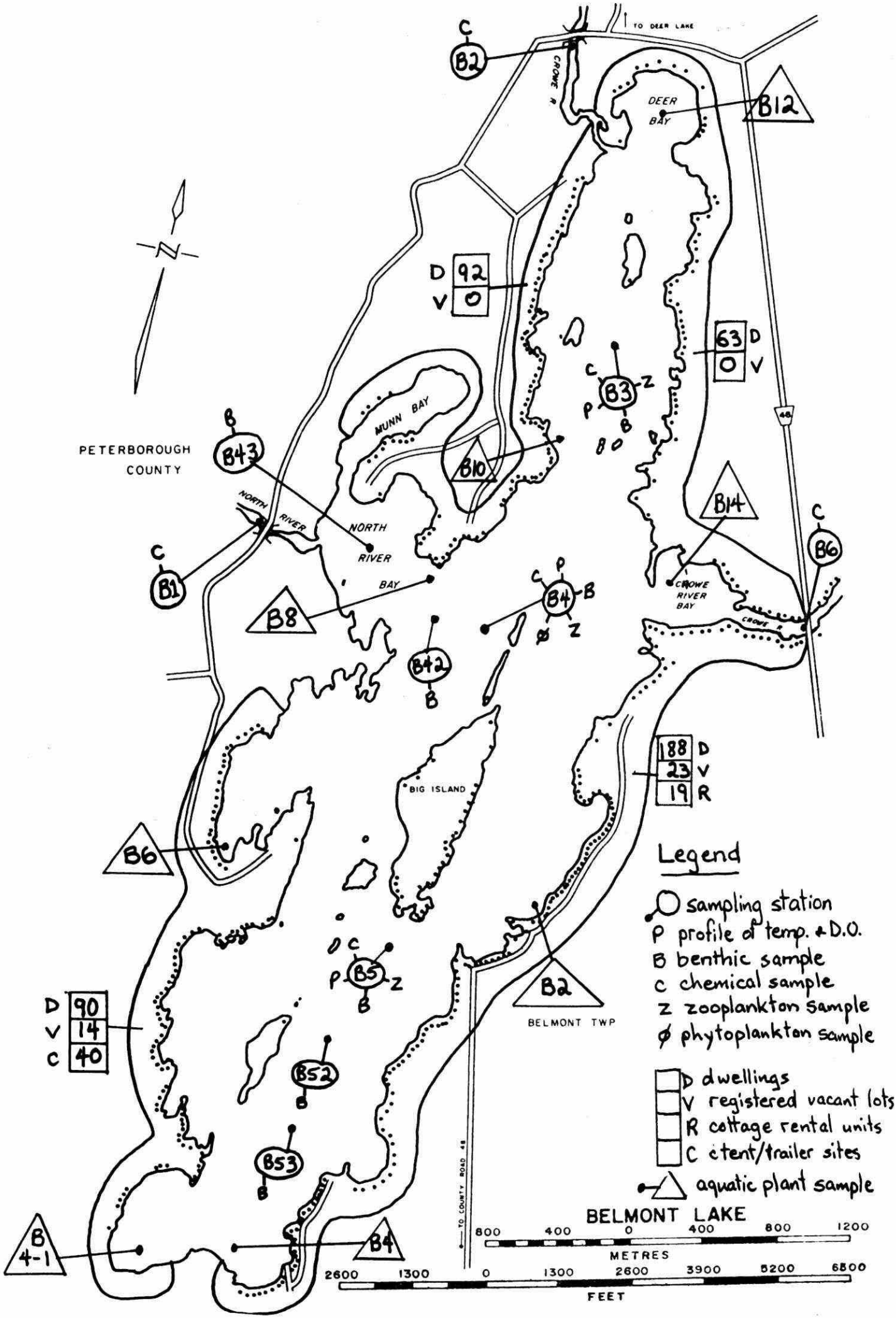
The benthic invertebrate community in the lake sediments was dominated in spring by Chironomidae and in fall by Chaoborus. Densities increased to numbers expected in eutrophic lakes. The composition and density of benthos in the lake suggested that it was mesotrophic.

The aquatic weed Myriophyllum spicatum was noted growing in dense beds in several areas in the lake. A chemical treatment program carried out on some of the problem areas during 1978 showed no measureable effects on lake water quality.

The historical information for the lake quality showed that the lake water quality status has not changed significantly since 1972.

The overall water quality status of Belmont Lake was considered moderately enriched or mestotrophic. The high flushing rate of the lake and the proportionately small contribution of phosphorus from shoreline development indicated that the lake was relatively insensitive to further unrestricted shoreline development.

Belmont Lake Sampling Locations and Development 1978



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LAKE BELMONT

Township Belmont County Peterborough

Joint 7 Links Planning Board - Ministry of the Environment Survey

Morphometry

Surface Area (Ao)	7.624	Km^2
Volume (V)	46.84	$x10^6m^3$
mean depth (Z)	6.2	m
maximum depth (Zm)	18	m
drainage basin (Ad)	1220	Km^2

Geology of basin (%)

plutonic	45
sedimentary	30
volcanic	10
limestone	15

Basin cover (%)

forested	>90
cleared	<10

Shoreline development

permanent dwellings	24
cottages	414
cottage rental units	19
campground units	40
registered undeveloped	41

Historical Record

For approximate location of Station B4

Year	Discharge ($x10^6m^3/yr$)	Tot. P. (ug/l)	Chlor. a (ug/l)	S.D. (m)	Phytopl. (mm^3l)	Zoopl. (No./l)	A.H.O.D. ($mg/m^2/day$)
1970							
1971							
1972		12	1.3	3.7			(242)
1973							
1974			1.2	4.3			
1975			2.2	4.0			
1976			1.8	4.1			
1977				5.3			
1978	491.66	12	2.0	4.1	0.27	11	306 (232)

LAKE BELMONT

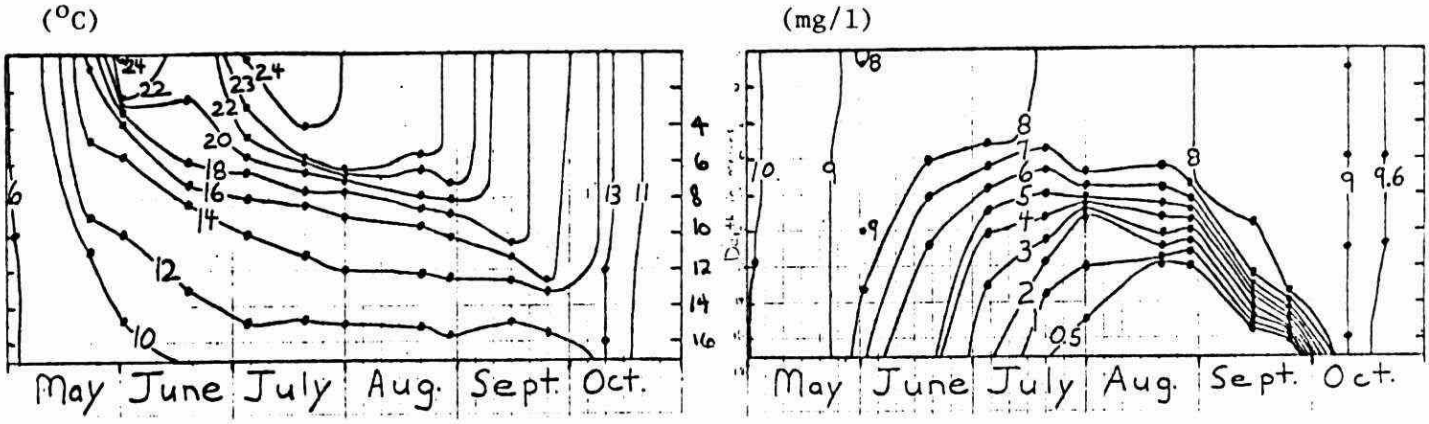
Station B 4

Chemistry 1978 (results in mg/l unless otherwise noted)

	NH_3	TKN	NO_2	NO_3	T. P.	Tot. Org. C	Inorg. C	pH	Cond. (umhos/cm^3)
euphotic max.	0.030	0.43	0.004	0.130	0.018	6.5	14.2	7.83	150
zone min.	0.002	0.33	0.002	0.005	0.007	5.5	11.0	6.90	124
mean	0.011	0.37	0.002	0.032	0.012	6.1	13.1	7.57	142
bottom max.	0.304	0.58	0.022	0.225	0.020	6.4	17.4	7.65	165
waters min.	0.006	0.27	0.001	0.005	0.010	5.4	14.0	6.88	128
mean	0.084	0.39	0.005	0.094	0.014	6.0	15.7	7.15	142

	Ca	Mg	Hard.	Na	K	Alk.	Cl	SO_4	Colour (Hazen U.)	Turbidity (F.T.U.)
euphotic max.	23.0	2.70	69	2.0	1.10	59	2.95	14.5	35	1.50
zone min.	19.2	2.15	57	1.9	0.95	45	2.60	13.0	19	0.65
mean	21.4	2.48	64	1.9	1.05	54	2.82	13.7	27	1.02
bottom max.	27.0	2.90	79	1.8	1.10	72	2.65	13.0	113	5.20
waters min.	21.0	2.45	63	1.7	0.95	56	2.40	11.5	22	1.00
mean	23.0	2.68	69	1.8	1.01	61	2.55	12.3	57	2.40

Temperature/Dissolved Oxygen 1978 Station B4



Annual Phosphorus Supply (Kg, %)

Land Runoff	5591	90.6
Atmosphere	381	6.2
Shoreline Development	198	3.2

LAKE BELMONT

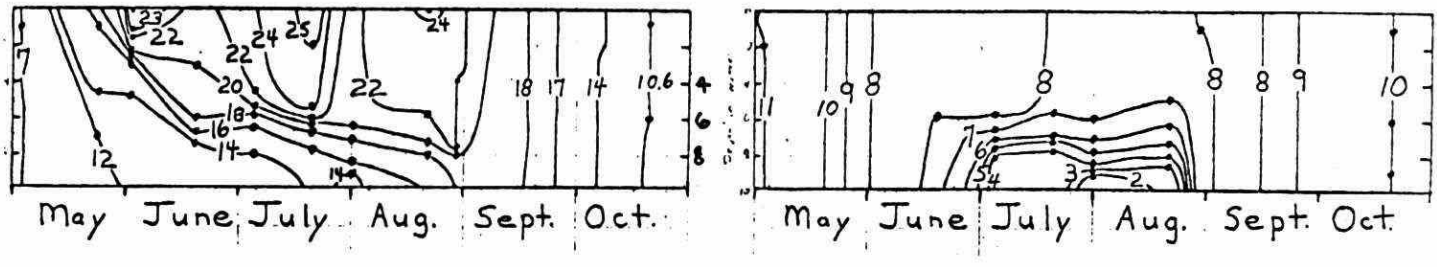
Chemistry 1978 (results in mg/l unless otherwise noted) Station B3

		NH_3	TKN	NO_2	NO_3	T. P.	Tot. C	Org. C	Inorg. C	pH	Cond. (umhos/cm^3)
euphotic zone	max.	0.012	0.39	0.003	0.115	0.014	6.7		14.2	7.90	150
	min.	0.002	0.31	0.002	0.005	0.006	5.8		9.2	6.56	116
	mean	0.006	0.34	0.002	0.028	0.010	6.2		12.5	7.50	140
bottom waters	max.										
	min.			euphotic zone usually reached bottom waters							
	mean										

		Ca	Mg	Hard.	Na	K	Alk.	Cl	SO_4	Colour (Hazen U.)	Turbidity (F.T.U.)
euphotic zone	max.	23.0	2.70	69	2.0	1.10	60	3.05	14.5	35	1.40
	min.	17.6	1.90	52	2.0	1.00	39	2.80	13.5	19	0.95
	mean	20.9	2.40	62	2.0	1.05	53	2.91	14.1	27	1.15
bottom waters	max.										
	min.			euphotic zone usually reached bottom waters							
	mean										

Temperature/Dissolved Oxygen 1978

(^oC) (mg/l)



Annual Phosphorus Supply (Kg, %)

Land Runoff	____	____
Atmosphere	____	____
Shoreline Development	____	____

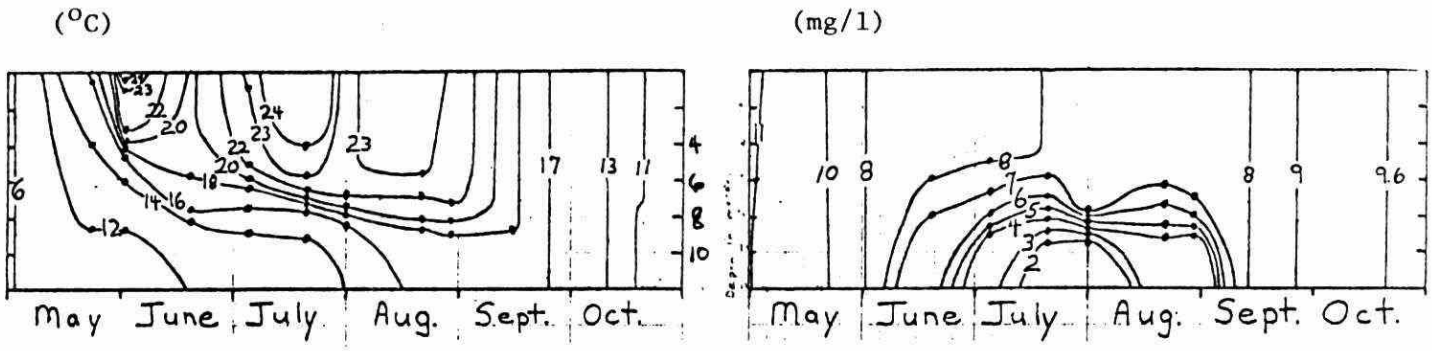
LAKE BELMONT

Chemistry 1978 (results in mg/l unless otherwise noted) Station B5

	NH_3	TKN	NO_2	NO_3	T. P.	Tot. Org. C	Inorg. C	pH	Cond. (umhos/cm^3)
euphotic max.	0.024	0.43	0.003	0.125	0.015	6.3	14.2	7.79	150
zone min.	0.004	0.30	0.002	0.005	0.007	5.0	12.2	6.95	125
mean	0.013	0.36	0.002	0.033	0.010	5.9	13.5	7.56	142
bottom max.	0.038	0.34	0.003	0.125	0.018			7.86	148
waters min.	0.004	0.27	0.002	0.005	0.005			7.20	125
mean	0.017	0.31	0.002	0.067	0.010	5.6	13.3	7.52	137

	Ca	Mg	Hard.	Na	K	Alk.	Cl	SO_4	Colour (Hazen U.)	Turbidity (F.T.U.)
euphotic max.	23.0	2.65	68	2.0	1.10	60	2.9	14.0	30	1.30
zone min.	19.8	2.35	59	1.7	0.90	51	2.5	10.5	17	0.95
mean	21.6	2.53	64	1.9	1.01	57	2.7	12.5	24	1.08
bottom max.										
waters min.	21.3	2.45	63	1.8	0.95	54	2.7	12.2	22	0.93
mean										

Temperature/Dissolved Oxygen 1978



Annual Phosphorus Supply (Kg, %)

Land Runoff	____	____
Atmosphere	____	____
Shoreline Development	____	____

LAKE BELMONT

Phytoplankton 1978
(% of total volume)

Cyanophyceae	32.0
Dinophyceae	11.4
Cryptophyceae	15.1
Chrysophyceae	11.8
Bacillariophyceae	23.5
Chlorophyceae	6.3

Common Species

Aphanizomenon
unid. dinophyceae
Anabaena
Tabellaria
Cryptomonas
Fragilaria
Dinobryon

Zooplankton 1978
(% of total numbers)

Calanoida	38.2
Cyclopoida	28.8
Cladocera	25.0
Nauplii	8.0

Common Species

Diaptomus oregonensis
Daphnia galeata mendotae
Daphnia pulex
Diaphanosoma leuchtenbergianum
Daphnia dubia
Cyclops scutifer

Benthos 1978
(% of total number)

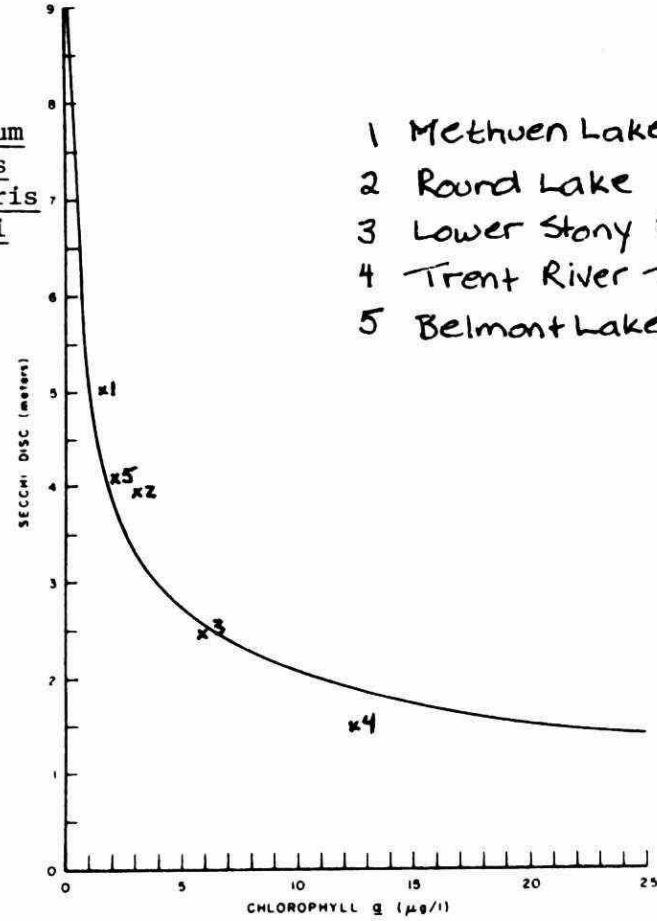
Tubificidae	3.7	0.1
Chironomidae	50.8	14.0
Chaoboridae	27.8	84.0
Other	17.7	2.0
Total (Organisms/m^2)	636	4774

Common Species

Chaoborus
Chironomus
Procladius
Tanytarsini

Aquatic Macrophytes

Batrachospermum sp.
Chara sp.
Potamogeton amplifolius
P. friesii
P. gramineus
P. illineoensis
P. praelongus
P. pusillus
P. richardsonii
P. robbinsii
P. strictifolius
P. zosteriformis
Najas flexilis
Elodea canadensis
Vallisneria americana
Heteranthera dubia
Ceratophyllum demersum
Nuphar variegatum
Nymphaea odorata
Ranunculus sp.
Amoracia aquatica
Myriophyllum exalbescens
M. heterophyllum
M. spicatum
Nymphoides cordatum
Lycopus americanus
Utricularia vulgaris
Megalodonta beckii



1 Methuen Lake
2 Round Lake R4
3 Lower Stony S27
4 Trent River T12
5 Belmont Lake B4

Ontario

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CORDOVA LAKE

Cordova Lake is located about 16 Km north east of the Village of Havelock in Belmont Township. The lake receives flow from the Crowe River and drains to Belmont Lake about 2 Km to the south. The lake has 15 permanent dwellings, 215 cottages, 3 rental units and 14 tent and trailer sites. The flushing rate during 1978 was very high (30.9 $yr.^{-1}$). The lake had moderately hard alkaline water with a relativey high amount of apparent colour. Water clarity as indicated by Secchi disc was moderately good and was probably depressed by the presence of colour in the water column. Based on Secchi disc alone, Cordova Lake was considered moderately enriched or mesotrophic.

Thermal stratification was noted at Station C2 from May to October, 1978.

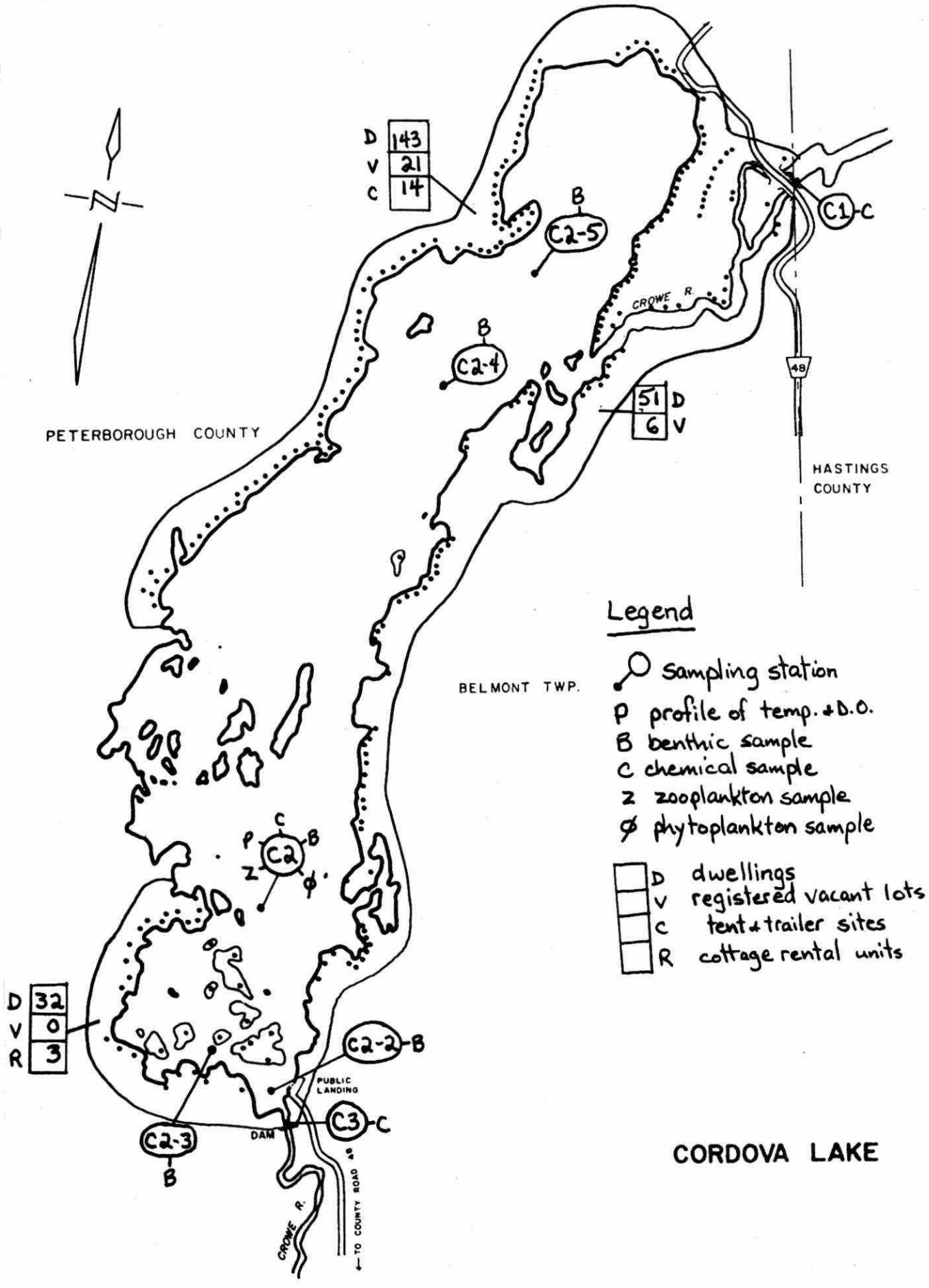
The dissolved oxygen distribution showed a clinograde (gradually decreasing in the bottom waters with depth) profile. The minimum dissolved oxygen concentration recorded was 0.0 mg/l. The decline in dissolved oxygen concentration with depth was probably caused by the decomposition of organic material accumulating in the bottom waters and the sediment oxygen demand. The rate of dissolved oxygen depletion in the bottom waters or the A.H.O.D. was calculated to be 226 mg/m^2 day. According to limits suggested by Mortimer (1941, 1942) the lake was considered oligotrophic. The mean total phosphorus concentration in the euphotic zone of the lake was low and indicated that the lake was unenriched or oligotrophic. Nutrient accumulation in the bottom waters was noted during the survey. Phytoplankton densities in the lake were favorably low. A fairly even balance of dominance between various groups of phytoplankton was evident. Based on phytoplankton density, Cordova Lake was considered unenriched or oligotrophic.

The crustacean zooplankton community of the lake was also evenly balanced in dominance between the very major groups. The low density of zooplankton indicated that the lake was unenriched.

The benthic inverbrate community was dominated by Chaoborus but the Chironomidae Chironomus and Procladius and the tubificidae Limnodrilus hoffmeisteri were also well represented. All of these organisms are well suited to life in waters of low dissolved oxygen concentration, but the latter two are more common to organically enriched sediments. The density of organisms indicated moderately enriched or mesotrophic conditions.

Cordova Lake was characterized by good water quality during 1978 and was considered oligotrophic but bordering on mesotrophic. In view of the high flushing rate and relatively large proportion of phosphorus coming from upstream sources, the lake was considered relatively insensitive to further unrestricted shoreline development.

Cordova Lake Sampling Locations and Development 1978



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LAKE CORDOVA

Township Belmont County Peterborough

Joint 7 Links Planning Board - Ministry of the Environment Survey

Morphometry

Surface Area (Ao)	2.743	Km^2
Volume (V)	10.98	$x10^6 m^3$
mean depth (Z)	4.4	m
maximum depth (Zm)	15.0	m
drainage basin (Ad)	842.988	Km^2

Geology of basin (%)

plutonic	50
sedimentary	45
volcanic	5
limestone	0

Basin cover (%)

forested	>90
cleared	<10

Shoreline development

permanent dwellings	15
cottages	215
cottage rental units	3
campground units	14
registered undeveloped	21

Historical Record

Year	Discharge ($x10^6 m^3/yr$)	Tot. P. (ug/l)	Chlor. a (ug/l)	S.D. (m)	Phytopl. ($mm^3 l$)	Zoopl. (No./l)	A.H.O.D. ($mg/m^2/day$)
1970							
1971							
1972							
1973							
1974							
1975							
1976							
1977				4.3			
1978	339.7	7	2.0	4.3	0.25	9	226

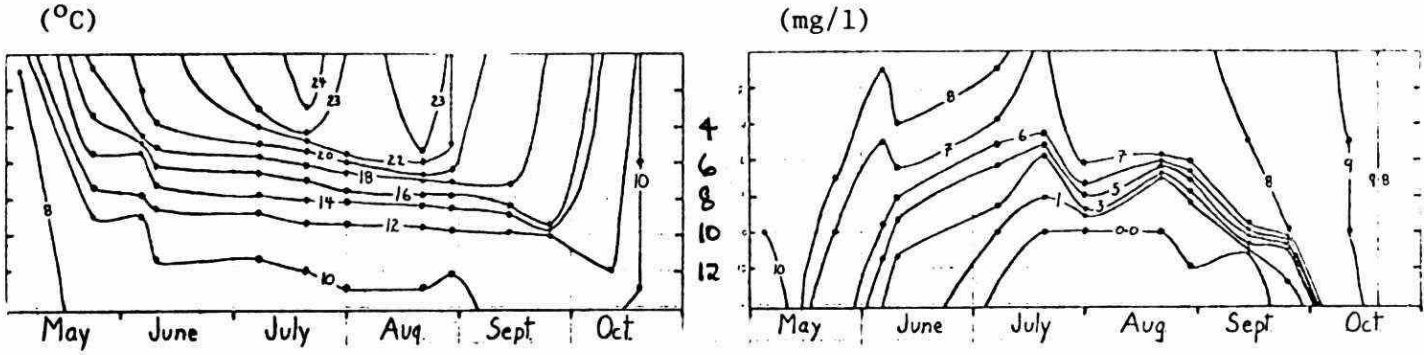
LAKE CORDOVA

Chemistry 1978 (results in mg/l unless otherwise noted) Station C2

	NH_3	TKN	NO_2	NO_3	T. P.	Tot. Org. C	Inorg. C	pH	Cond. (umhos/cm^3)
euphotic max.	0.024	0.38	0.004	0.085	0.008	7.6	14.0	7.72	155
zone min.	0.008	0.23	0.002	0.010	0.003	6.0	7.6	7.42	114
mean	0.015	0.34	0.002	0.030	0.007	6.8	11.9	7.57	143
bottom max.	0.490	0.70	0.004	0.090	0.064	7.7	16.0	7.69	460
waters min.	0.010	0.20	0.002	0.005	0.003	6.0	7.6	6.91	114
mean	0.172	0.47	0.002	0.041	0.031	7.1	12.5	7.19	179

	Ca	Mg	Hard.	Na	K	Alk.	Cl	SO_4	Colour (Hazen U.)	Turbidity (F.T.U.)
euphotic max.	23.0	2.70	69	2.1	1.15	59	3.3	16.0	45	1.00
zone min.	17.4	1.80	51	2.0	1.05	38	3.0	14.0	25	0.80
mean	21.1	2.37	63	2.0	1.10	52	3.2	14.8	37	0.90
bottom max.	23.0	2.60	68	2.1	1.15	59	3.4	16.0	296	4.00
waters min.	17.4	1.85	51	1.8	1.05	38	2.9	11.5	25	1.00
mean	20.5	2.25	60	2.0	1.10	52	3.1	14.0	119	2.10

Temperature/Dissolved Oxygen 1978 Station C2



Annual Phosphorus Supply (Kg, %)

Land Runoff	2835	92.3
Atmosphere	137	4.5
Shoreline Development	99	3.2

LAKE CORDOVA

Phytoplankton 1978
(% of total volume)

Cyanophyceae	20.5
Dinophyceae	1.2
Cryptophyceae	35.8
Chrysophyceae	15.0
Bacillariophyceae	23.2
Chlorophyceae	4.3

Common Species

Cryptomonas
Fragilaria
Aphanizomenon
Rhodomonas

Zooplankton 1978
(% of total numbers)

Calanoida	27.5
Cyclopoida	36.7
Cladocera	28.7
Nauplii	7.2

Common Species

Daphnia galeata mendotae
Diaphanosoma leuchtenbergianum
Diaptomus oregonensis
Cyclops scutifer
Mesocyclops edax

Benthos 1978
(% of total number)

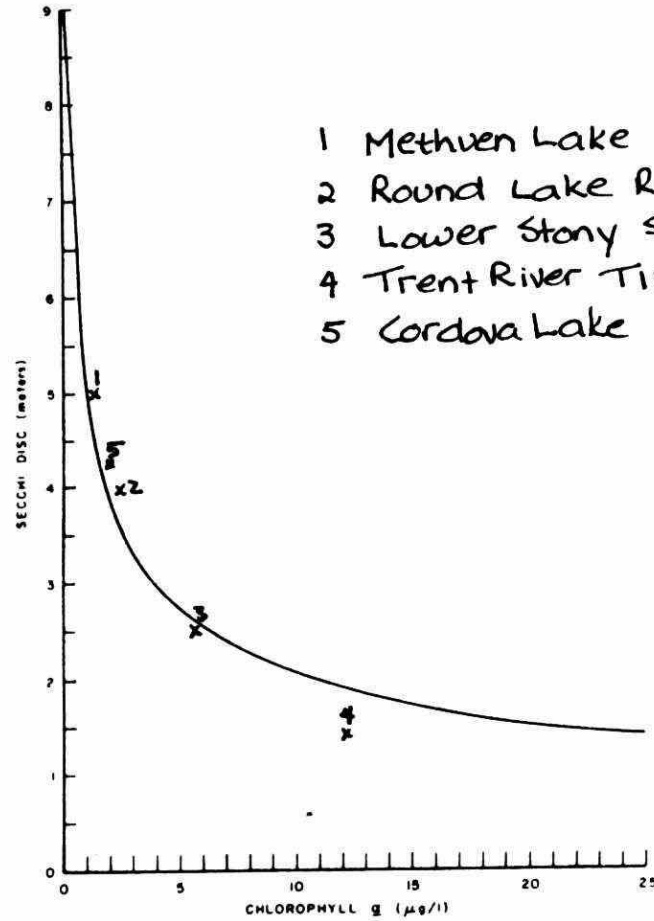
Tubificidae	13.8
Chironomidae	27.2
Chaoboridae	51.9
Other	2.8
Total (Organisms/m^2	1854

Common Species

Chaoborus
Chironomus
unid. Tubificid
Procladius

Aquatic Macrophytes

Chara sp.
Nitella sp.
Sparganium sp.
Potemogeton amplifolius
P. epihydrus
P. gramineus
P. natans
P. pusillus
P. richardsonii
P. robbinsii
P. zosteriformis
Najas flexilis
Sagittaria sp.
Elodea canadensis
Vallisneria americana
Pontederia cordata
Heteranthera dubia
Polygonum amphibium
Ceratophyllum demersum
Brasenia schreberi
Nuphar variegatum
Nymphea odorata
Ranunculus sp
Amoracia aquatica
Myriophyllum alterniflorum
M. exalbescens
M. heterophyllum
Megalodonta beckii



1 Methven Lake
2 Round Lake R4
3 Lower Stony S27
4 Trent River T12
5 Cordova Lake

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CROWE LAKE

Crowe Lake is located about 2 Km north west of the Town of Marmora in the Townships of Marmora and Belmont. The lake receives most inflow from the Crowe River with a minor flow from Plato Creek. The lake discharges to the Crowe River which flows to the Trent River.

There were about 328 cottages, 23 rental units and 425 campground sites on the lakeshore. The lake volume flushed about 12 times during 1978.

Crowe Lake has moderately hard alkaline water with a moderately high amount of apparent colour. Water clarity as indicated by Secchi disc was moderately good with an average value of 3.9m at Station C7 and 4.0m at Station C6. Based on this parameter alone, the Lake was considered moderately enriched or mesotrophic.

Thermal stratification was noted at Stations C6 and C7 during the sampling period.

The dissolved oxygen distribution at both stations was clinograde (gradually decreasing within the bottom waters with depth). The minimum concentration noted in the bottom waters was 0.0 mg/l. The decline in D.O. concentration was probably due to the decomposition of organic material accumulating in the bottom waters and the sediment oxygen demand.

The total phosphorus concentration in the euphotic zone was moderately low during the sampling period. An accumulation of nutrients was noted in the bottom waters at Station C7.

The phytoplankton density was moderately low but the common forms were common to enriched conditions. Based on phytoplankton density and composition, the lake was considered mesotrophic or moderately enriched.

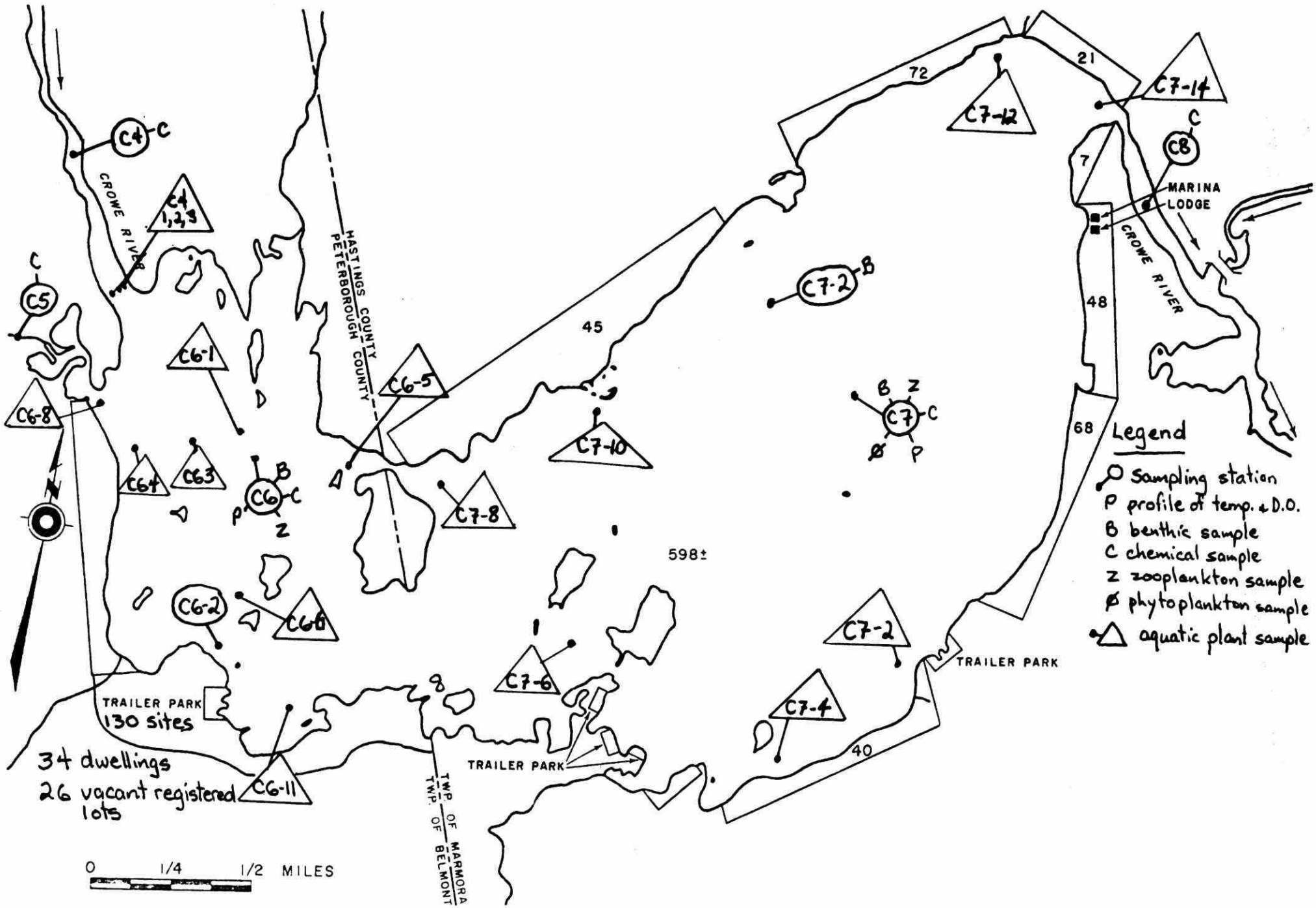
The crustacean zooplankton community was dominated by cladocera but with calanoida also well represented. Density and composition of this community indicated that the lake was moderately enriched or mesotrophic.

High densities of benthic invertebrates were found in the deep lake sediments of the eastern basin. The benthic community was dominated by Chaoborus, an organism that tolerates low oxygen conditions. Based on benthic invertebrate density, the lake was considered eutrophic.

In summary, the water quality status of Crowe Lake was considered to be mesotrophic. The Lake was considered relatively insensitive to further unrestricted shoreline development.

Although the water quality was somewhat enriched, the high flushing rate for the lake and the high portion of phosphorus from upstream sources indicated that the lake was relatively insensitive to a significant increase in phosphorus input.

Crowe Lake Sampling Locations 1978 (Development for Belmont Tp 1978, for Marmora Tp 1972)



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LAKE CROWE

Township Belmont
Marmora

County Peterborough
Hastings

Joint 7 Links Planning Board - Ministry of the Environment Survey

Morphometry

Surface Area (Ao)	8.757	Km^2
Volume (V)	49.38	$x10^6 m^3$
mean depth (Z)	5.6	m
maximum depth (Zm)	15.8	m
drainage basin (Ad)	1444.2	Km^2

Geology of basin (%)

plutonic	47
sedimentary	26
volcanic	10
limestone	17

Basin cover (%)

forested	>90
cleared	<10

Shoreline development

permanent dwellings	
cottages	328
cottage rental units	23
campground units	425
registered undeveloped	

Historical Record

Year	Discharge ($x10^6 m^3/yr$)	Tot. P. (ug/l)	Chlor. a (ug/l)	S.D. (m)	Phytopl. ($mm^3 l$)	Zoopl. (No./l)	A.H.O.D. ($mg/m^2/day$)
1970	403						
1971	471						
1972	712	16	1.7	3.8			
1973	622						
1974	640		1.2	4.7*			
1975	409		2.7	4.7*			
1976	530		3.3	4.7*			
1977	332			3.9*			
1978	585	10	2.9	3.9	0.49 (Sta C7)	20	
		12	2.7	4.0	0.65 (Sta C6)		

*self help data

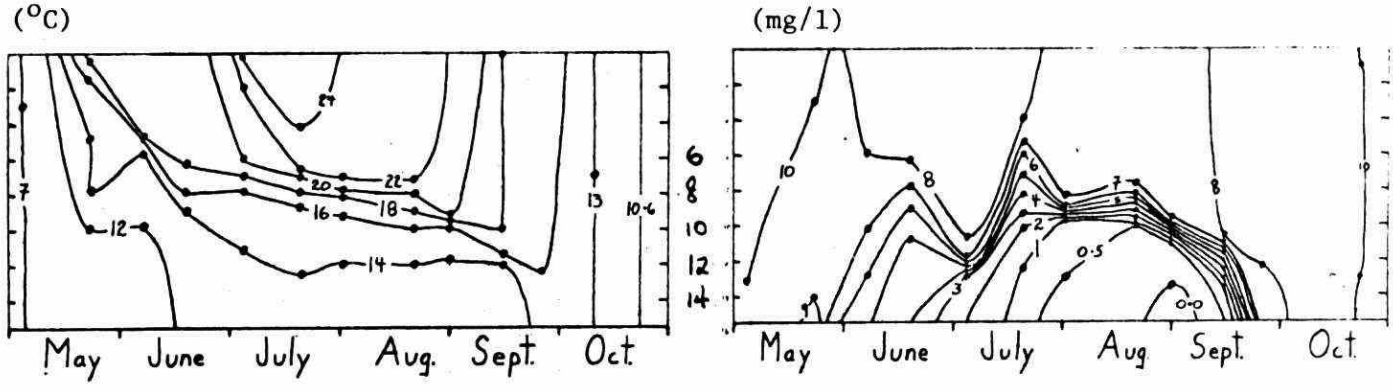
LAKE CROWE

Chemistry 1978 (results in mg/l unless otherwise noted) Station C7

	NH_3	TKN	NO_2	NO_3	T. P.	Tot. Org. C	Inorg. C	pH	Cond. (umhos/cm^3)
euphotic max.	0.016	0.37	0.004	0.130	0.016	6.6	14.6	7.89	155
zone min.	0.004	0.31	0.001	0.005	0.004	5.4	11.6	7.46	138
mean	0.008	0.34	0.002	0.026	0.010	6.2	13.5	7.69	148
bottom max.	0.160	0.48	0.004	0.135	0.048	6.4	16.4	7.73	155
waters min.	0.006	0.26	0.001	0.005	0.006	5.2	11.6	6.94	135
mean	0.042	0.33	0.002	0.066	0.016	5.9	14.2	7.31	145

	Ca	Mg	Hard.	Na	K	Alk.	Cl	SO_4	Colour (Hazen U.)	Turbidity (F.T.U.)
euphotic max.	24.0	2.70	71	2.3	1.10	61	3.1	14.0	35	1.60
zone min.	21.6	2.50	64	1.9	0.95	53	2.8	12.5	17	0.85
mean	22.9	2.60	68	2.1	1.03	58	3.0	13.2	26	1.35
bottom max.	24.0	2.60	71	2.2	1.15	64	3.1	14.0	146	3.10
waters min.	21.6	2.45	64	1.9	0.90	54	2.8	11.5	21	1.00
mean	22.5	2.55	67	2.0	1.03	60	3.0	12.8	66	1.80

Temperature/Dissolved Oxygen 1978



Annual Phosphorus Supply (Kg, %)

Land Runoff	7159	91.5
Atmosphere	438	5.6
Shoreline Development	225	2.9

LAKE CROWE

Chemistry 1978 (results in mg/l unless otherwise noted) Station C6

	NH_3	TKN	NO_2	NO_3	T. P.	Tot. Org. C	Inorg. C	pH	Cond. (umhos/cm^3)
euphotic max.	0.046	0.43	0.004	0.125	0.017	6.5	14.8	7.85	160
zone min.	0.006	0.30	0.001	0.005	0.008	5.4	9.8	7.44	125
mean	0.022	0.37	0.002	0.026	0.012	6.1	13.0	7.58	148
bottom max.									
waters min.									
mean									

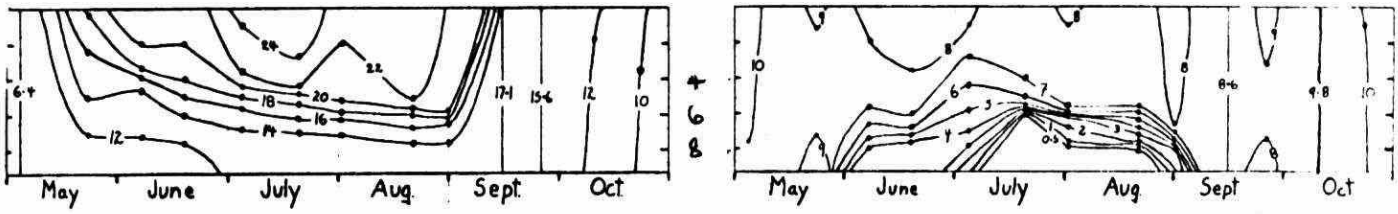
euphotic zone usually reached bottom waters

	Ca	Mg	Hard.	Na	K	Alk.	Cl	SO_4	Colour (Hazen U.)	Turbidity (F.T.U.)
euphotic max.	23.0	2.75	69	2.0	1.25	61	3.1	15.0	37	1.8
zone min.	19.6	2.25	58	1.9	0.90	47	2.5	12.5	18	1.5
mean	21.9	2.55	65	2.0	1.03	56	2.9	13.5	30	1.6
bottom max.										
waters min.										
mean										

euphotic zone usually reached bottom waters

Temperature/Dissolved Oxygen 1978

(^oC) (mg/l)



Annual Phosphorus Supply (Kg, %)

Land Runoff	_____	_____
Atmosphere	_____	_____
Shoreline Development	_____	_____

LAKE CROWE

Phytoplankton 1978
(% of total volume)

	C7	C6
Cyanophyceae	11.2	12.7
Dinophyceae	8.6	8.4
Cryptophyceae	12.0	44.3
Chrysophyceae	18.2	16.9
Bacillariophyceae	47.3	16.6
Chlorophyceae	2.7	1.1

Common Species

C7
Rhizosolenia
Fragilaria
Melosira
Dinobryon
unid. chrysomonads
Aphanizomenon
Rhodomonas
Cryptomonas
Ceratium

C6
Cryptomonas
Oscillatoria
Melosira
unid. dinophyceae

Zooplankton 1978
(% of total numbers)

	C7
Calanoida	24.6
Cyclopoida	33.0
Cladocera	37.6
Nauplii	4.7

Common Species
Daphnia retrocurva
Diaphanosoma leuchtenbergianum
Bosmina
Diaptomus oregonensis
Cyclops scutifer
Mesocyclops edax

Benthos 1978
(% of total number)

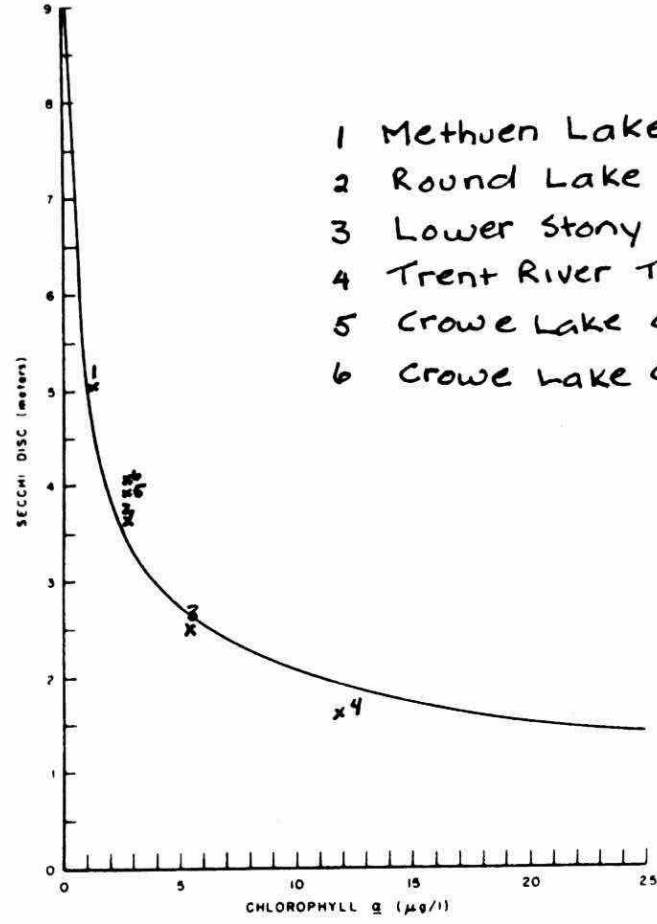
	C6	early summer	late summer
Tubificidae	0	6.0	2.5
Chironomidae	49.3	9.1	3.4
Chaoboridae	50.7	79.9	93.7
Other	0	5.1	0.5
Total (Organisms/m^2 258		3626	12437

Common Species

Chaoborus
Chironomus
Procladius

Aquatic Macrophytes

Chara sp.
Potamogeton amplifolius
P. friesii
P. gramineus
P. illinoensis
P. pectinatus
P. praelongus
P. pusillus
P. richardsonii
P. robbinsii
P. strictifolius
P. zosteriformis
Najas flexilis
Sagittaria sp.
Elodea canadensis
Vallisneria americana
Heteranthera dubia
Cerataphyllum demersum
Nuphar variegatum
Amoracia aquatica
Myriophyllum exalbescens
M. heterophyllum
M. spicatum
Utricularia vulgaris
Megalodonta beckii



1 Methuen Lake
2 Round Lake R4
3 Lower Stony S27
4 Trent River T12
5 Crowe Lake C7
6 Crowe Lake C6

Ontario

Ministry of the Environment

Central Region

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DUMMER LAKE

Dummer Lake is located about 21 Km north west of the Village of Havelock in Dummer Township. The lake receives water from Gilchrist Bay of Stony Lake and flows into the Indian River. A dam controlled by Parks Canada, regulates the flow from Gilchrist Bay into the lake. The lake has about 17 permanent dwellings and 151 cottages along its shoreline. The lake flushing rate was relatively high because of the water allowed into the lake from Gilchrist Bay.

The lake had hard alkaline water with relatively low apparent colour. Water clarity as indicated by Secchi disc was moderate and indicated that the lake was mesotrophic or moderately enriched.

Because of the broad, shallow nature of the lake basin, no thermal stratification was noted during 1978.

The dissolved oxygen concentration was at or near saturation through the water column and at all sampling dates.

The total phosphorus concentration in the euphotic zone was moderate. Based on this parameter, the lake was considered moderately enriched or mesotrophic.

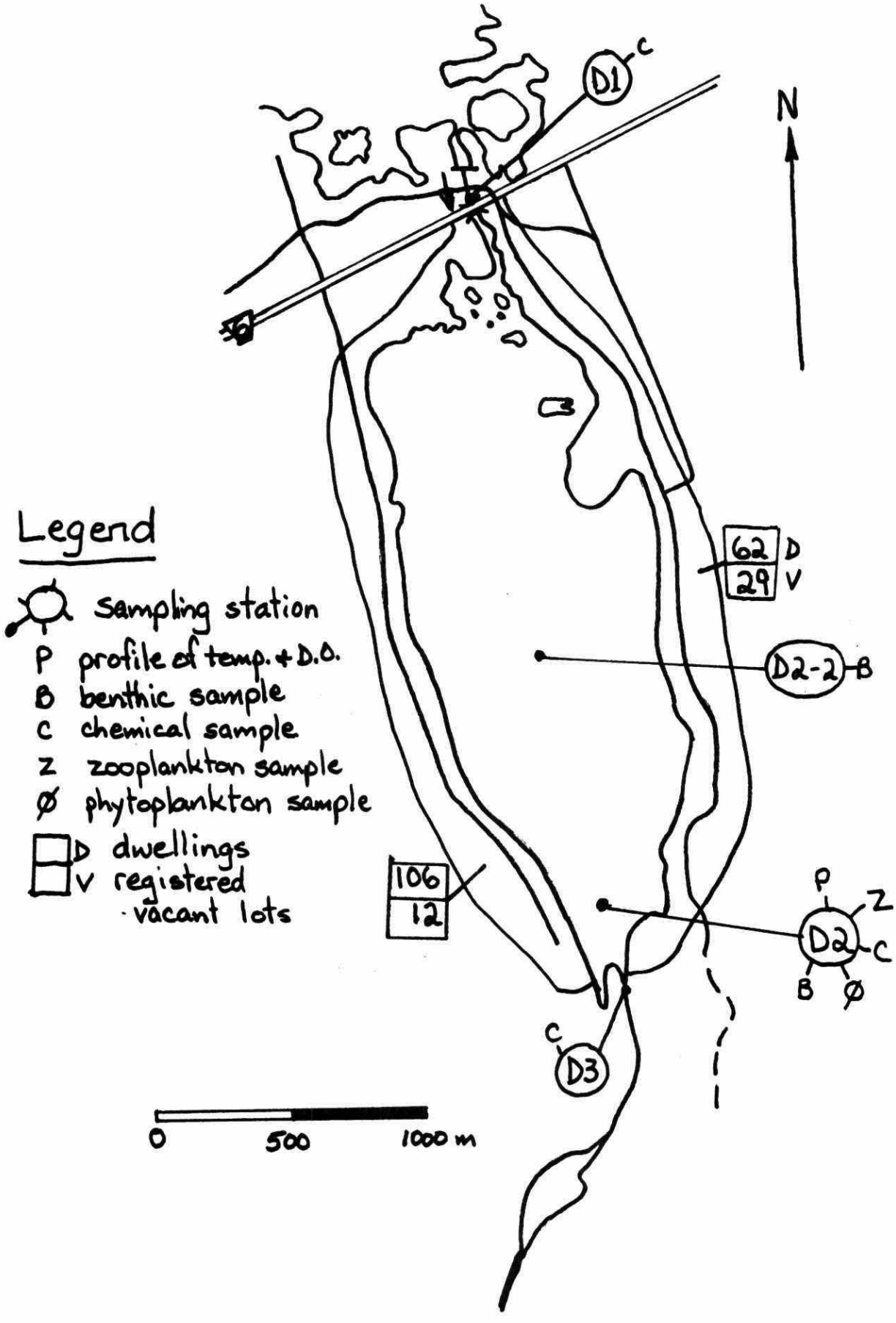
Phytoplankton density in the euphotic zone was moderate. The composition of the phytoplankton community was very similar to the lower basin of Stony Lake. This similarity suggested that the water quality of Dummer Lake was strongly influenced by the quality of the water flowing into the lake from Gilchrist Bay. Based on phytoplankton density and composition, Dummer Lake was considered moderately enriched or mesotrophic.

The zooplankton community was dominated by Cladocera and Cyclopoida with moderately high densities. The Cladocera typically dominate in moderately enriched to enriched waters.

Low densities of benthic invertebrates in the deeper lake sediments may have been due to the presence of marl ($CaCo_3$ deposits).

Dummer Lake was characterized by moderate water quality and was considered mesotrophic. The lake water quality was found to be strongly influenced by the upstream waters of Gilchrist Bay. The lake was considered to have low sensitivity to further unrestricted shoreline development.

Dumoner Lake Sampling Locations and Development 1978



Legend

- Sampling station
- P profile of temp. + D.O.
- B benthic sample
- C chemical sample
- Z zooplankton sample
- Ø phytoplankton sample
- D dwellings
- V registered vacant lots

Ontario

Ministry of the Environment

Central Region

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LAKE DUMMER

Township Dummer County Peterborough

Joint 7 Links Planning Board - Ministry of the Environment Survey

Morphometry

Surface Area (Ao)	1.762	Km^2
Volume (V)	5.34	$x10^6 m^3$
mean depth (Z)	3.0	m
maximum depth (Zm)	8.0	m
drainage basin (Ad)	10.36	Km^2 (immediate)

Geology of basin (%)

(immediate basin)

plutonic	
sedimentary	10
volcanic	
limestone	90

Basin cover (%)

forested	>90
cleared	<10

Shoreline development

permanent dwellings	17
cottages	151
cottage rental units	0
campground units	0
registered undeveloped	41

Historical Record

Year	Discharge ($x10^6 m^3$/yr)	Tot. P. (ug/l)	Chlor. a (ug/l)	S.D. (m)	Phytopl. ($mm^3$1)	Zoopl. (No./l)	A.H.O.D. (mg/m^2/day)
1970							
1971							
1972							
1973							
1974							
1975							
1976							
1977							
1978	42.8	14	3.9	3.8	0.83	28	

LAKE Dummer

Chemistry 1978 (results in mg/l unless otherwise noted)

		NH_3	TKN	NO_2	NO_3	T. P.	Tot. Org. C	Inorg. C	pH	Cond. (umhos/cm^3)
euphotic zone	max.	0.024	0.59	0.003	0.105	0.030	6.4	24.0	8.77	225
	min.	0.006	0.32	0.001	0.005	0.004	4.2	20.6	7.84	195
	mean	0.011	0.44	0.011	0.026	0.014	5.5	21.9	8.29	210
bottom waters	max.									
	min.									
	mean									

euphotic zone usually reached bottom waters

		Ca	Mg	Hard.	Na	K	Alk.	Cl	SO_4	Colour (Hazen U.)	Turbidity (F.T.U.)
euphotic zone	max.	41	3.15	115	2.6	0.90	100	4.6	15.0	19	1.4
	min.	32	3.05	92	2.6	0.70	86	4.1	12.5	10	0.6
	mean	35	3.10	100	2.6	0.82	91	4.4	13.5	14	1.1
bottom waters	max.										
	min.										
	mean										

euphotic zone usually reached bottom waters

Temperature/Dissolved Oxygen 1978

(^oC) (mg/l)

non-stratified

at or near saturation through sampling period.

Annual Phosphorus Supply (Kg, %)

Land Runoff	615	79.4
Atmosphere	88	11.4
Shoreline Development	72	9.3

LAKE Dummer

Phytoplankton 1978
(% of total volume)

Cyanophyceae	15.5
Dinophyceae	9.3
Cryptophyceae	14.4
Chrysophyceae	23.4
Bacillariophyceae	33.7
Chlorophyceae	3.8

Common Species

Melosira
Cryptomonas
Anabaena
Tabellaria
Rhizosolenia
Chrysosphaerella

Zooplankton 1978
(% of total numbers)

Calanoida	14.2
Cyclopoida	41.7
Cladocera	40.0
Nauplii	4.1

Common Species

Daphnia retrocurva
Daphnia dubia
Holopedium gibberum
Diaphanosoma leuchtenbergianum
Daphnia galeata mendotae
Daphnia catawba
Diaptomus oregonensis
Mescyclops edax
Cyclops bicuspidatus thomosi

Benthos 1978

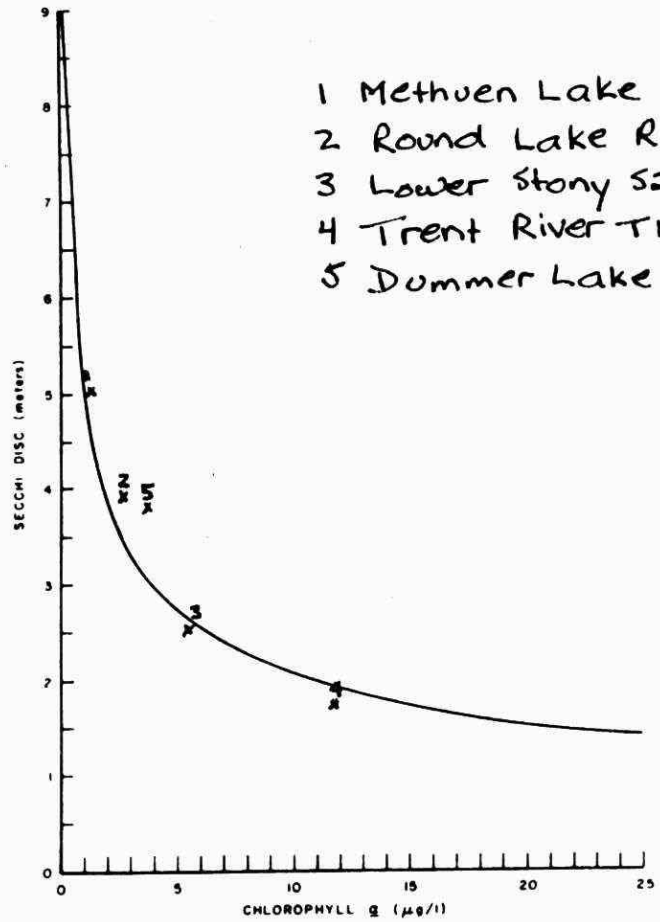
(% of total number)	early summer	late summer
Tubificidae	0	0
Chironomidae	100	50
Chaoboridae	0	50
Other	0	0
Total (Organisms/m^2	28	38

Common Species

unid. chironomini
Procladius
Chaoborus

Aquatic Macrophytes

Chara sp
Potamogeton amplifolius
P. gramineus
P. illinoensis
P. pectinatus
P. praelongus
P. pusillus
P. richardsonii
P. robbinsii
P. zosteriformis
Najas flexilis
Elodea canadensis
Vallisneria americana
Heteranthera dubia
Ceratophyllum demersum
Nymphea odorata
Myriophyllum exalbescens
M. spicatum
Megalodonta beckii



1 Methven Lake
2 Round Lake R4
3 Lower Stony 527
4 Trent River T12
5 Dummer Lake

Ontario

Ministry of the Environment

Central Region

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JACK LAKE

Jack Lake is located about 32 Km north of the Village of Havelock in Methuen and Burleigh Townships. The lake drains into Jack Creek which enters Stony Lake of the Trent River system. The lake is naturally divided by islands and narrows that result in different water quality characteristics and flow patterns for the various bays. For the purposes of this report, the lake was divided into a north and south portion at the upstream end of Rathbun Bay.

The north portion of the Lake has 233 cottages, 12 cottage rental units and a trailer park with 100 tent and trailer sites. The south portion has 217 cottages. The lake flushing rate for the north portion is relatively low (0.74 yr^{-1}) and even lower in the south portion (0.33 yr^{-1}). Sharpe Bay is expected to have the lowest flushing rate of the lake.

Jack Lake has moderately hard, slightly alkaline water with a slight increasing trend in hardness, alkalinity and conductivity from Brook's Bay (J4) to William's Bay (J9). Thermal stratification was noted at all lake stations after spring turnover. Water clarity as indicated by Secchi disc was good with slightly higher mean values in the south portion of the lake. Based on mean Secchi disc alone the lake was considered moderately enriched or mesotrophic.

Dissolved oxygen distribution differed between the north bays and the south bays. In the north portion of the lake a slight maximum in dissolved oxygen concentration within the thermocline was noted at Stations J5 and J6 during the spring. However, through most of the sampling period, a clinograde profile (gradually decreasing within the bottom waters with depth) was evident. The dissolved oxygen concentration in the bottom waters decreased to less than 0.5 mg/l by late summer. The decline was probably due to the decomposition of organic matter and the oxygen demand of the sediments.

In the south portion, the dissolved oxygen distribution at Stations J7, J8 and J9 showed a pronounced maximum in dissolved oxygen concentration within the thermocline. The maximum was likely due to the production of oxygen by phytoplankton inhabiting that layer of water. This natural source of oxygen is dependent on continued good water clarity. Gradual decreases in dissolved oxygen concentration were noted in the bottom waters at all three stations. A maximum in dissolved oxygen within the thermocline with bottom water declines is common in mesotrophic lakes.

Mean total phosphorus concentration in the surface waters of the lake stations ranged between 9 and 14 ugP/l. Based on total phosphorus concentration, Jack Lake was considered on the border between oligotrophy and mesotrophy. Significant accumulations of total phosphorus and ammonia were occurring in the bottom waters at Stations J8 and J9. The accumulations may have indicated that some phosphorus was being released from the sediments. If this accumulation were to take place at other lake stations in Jack Lake through increased dissolved oxygen depletion, more nutrients would be made available for phytoplankton growth.

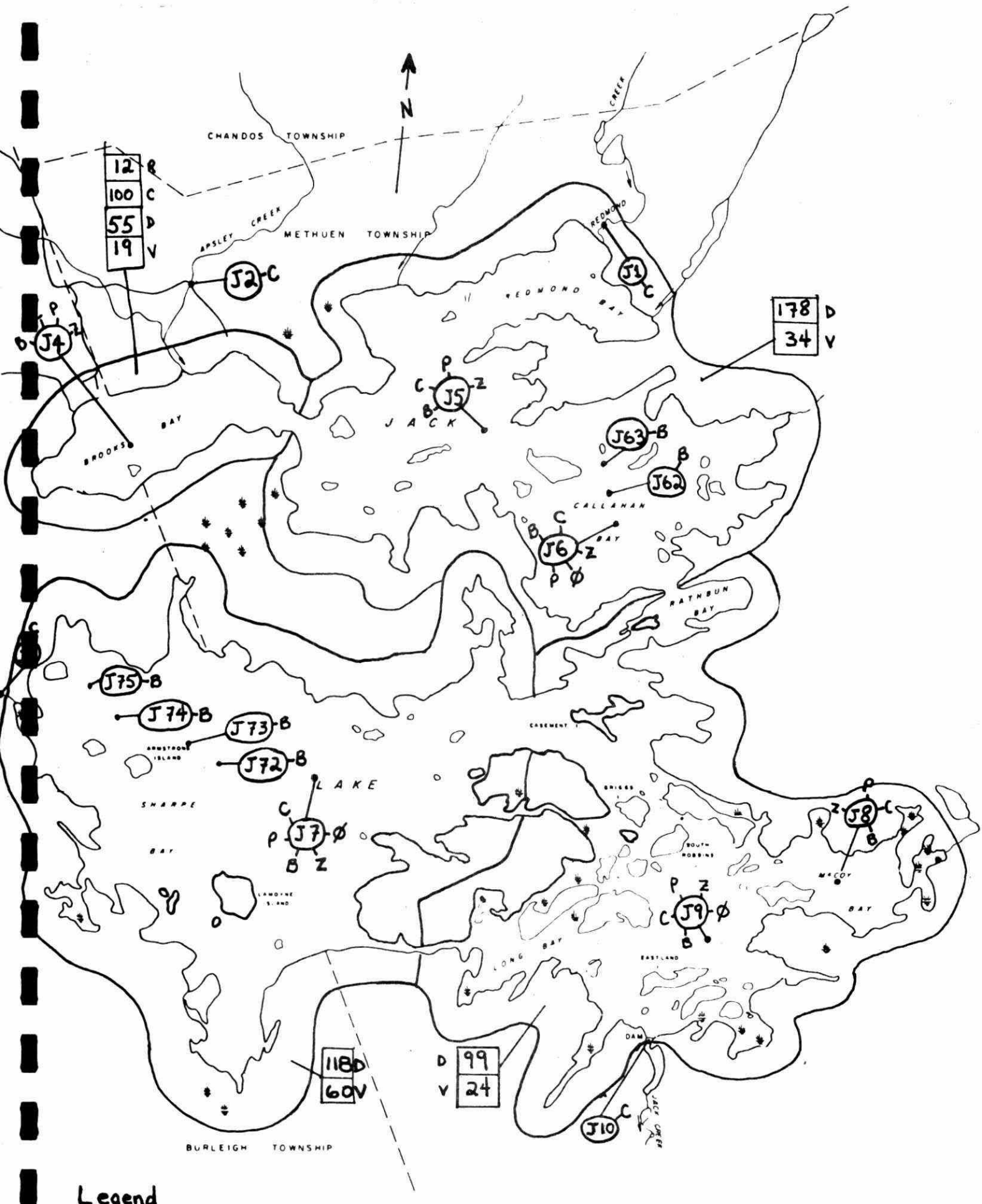
Phytoplankton density as indicated by chlorophyll a concentration and composite algal volume determinations was moderate. The lake was considered mesotrophic. The phytoplankton community in the north portion of the lake was dominated by the Cyanophyceae (blue-green algae) and the Bacillariophyceae (diatoms). Aphanizomenon and Oscillatoria were two common types of algae at Station J6 and are known to cause unsightly algal "blooms" in other more enriched lakes. Aphanizomenon, the most common form, requires at least moderate nutrient concentrations to thrive. With a significant increase in total phosphorus concentration undesirable algae blooms may occur in Jack Lake. In the south portions of the lake, Bacillariophyceae and Chrysophyceae were more common, indicating better water quality conditions. However, the bloom forming blue-green algae were still well represented.

Crustacean zooplankton densities were moderately high and the community throughout the lake was dominated by Cladocera and Cyclopoida. The zooplankton community and density indicated that the lake was moderately enriched.

The benthic invertebrate community of the north portion of the lake was dominated by Chaoborus with Chironomidae and tubicidae also present, indicating poorer water quality conditions. All organisms found were suited to living in low dissolved oxygen conditions. Densities of invertebrates were low indicated oligotrophic conditions.

In summary, Jack Lake had good water quality and was considered mesotrophic. Several factors that were brought to light during the study indicated that Jack Lake is sensitive to significant increases in phosphorus input. Unrestricted shoreline development, especially in view of the relatively large number of existing vacant registered lots, could have a significant impact on the water quality of the lake.

Jack Lake Sampling Locations and Development 1978



Legend

- sampling station
- P profile of temp. and D.O.
- B benthic sample
- C chemical sample
- Z zooplankton sample
- Ø phytoplankton sample
- D dwellings
- V registered vacant lots
- C camp/trailer sites
- R cottage rental units

kilometer 0 1

0 miles 1

Ontario

Ministry of the Environment

Central Region

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LAKE JACK (North Portion)

Township Methuen
Burleigh

County Peterborough

Joint 7 Links Planning Board - Ministry of the Environment Survey

Morphometry

Surface Area (Ao)	5.16	Km^2
Volume (V)	27.94	$x10^6m^3$
mean depth (Z)	5.4	m
maximum depth (Zm)	22.0	m
drainage basin (Ad)	48.58	Km^2

Geology of basin (%)

plutonic	7
sedimentary	93
volcanic	0
limestone	0

Basin cover (%)

forested	>90
cleared	<10

Shoreline development

permanent dwellings	0
cottages	233
cottage rental units	12
campground units	100
registered undeveloped	53

Historical Record

Station J4

Year	Discharge ($x10^6m^3/yr$)	Tot. P. (ug/l)	Chlor. a (ug/l)	S.D. (m)	Phytopl. (mm^3l)	Zoopl. (No./l)	A.H.O.D. ($mg/m^2/day$)
1970		13					
1971			2.6	4.0			
1972							
1973							
1974			1.9	3.4			
1975							
1976			3.7	3.4			
1977			-	3.5			
1978	20.76	12	3.4	3.8	-	25	-
1978	Station J6	9	3.3	4.5	0.51	23	-

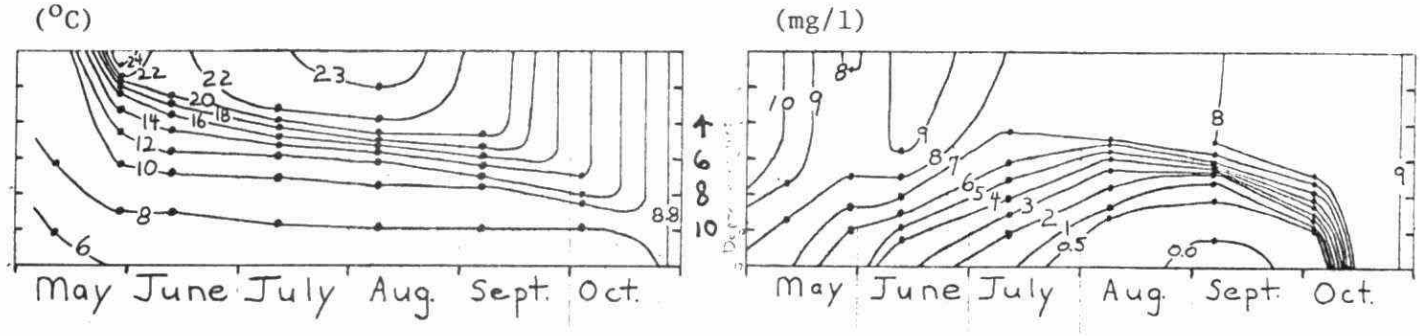
LAKE JACK

Chemistry 1978 (results in mg/l unless otherwise noted) Station J4

	NH_3	TKN	NO_2	NO_3	T. P.	Tot. Org. C	Inorg. C	pH	Cond. (umhos/cm^3)
euphotic max.	0.024	0.40	0.003	0.100	0.020	7.8	11.0	7.50	115
zone min.	0.008	0.28	0.001	0.005	0.006	6.9	8.4	7.09	104
mean	0.012	0.36	0.002	0.026	0.012	7.3	10.1	7.34	111
bottom max.	0.118	0.46	0.003	0.188	0.032	7.6	13.2	7.82	115
waters min.	0.004	0.22	0.002	0.005	0.012	7.0	9.4	6.71	108
mean	0.076	0.38	0.002	0.056	0.021	7.3	11.3	7.18	112

	Ca	Mg	Hard.	Na	K	Alk.	Cl	SO_4	Colour (Hazen U.)	Turbidity (F.T.U.)
euphotic max.	19.6	1.80	53	1.3	1.05	45	1.9	11.5	39	1.8
zone min.	16.6	1.60	48	1.2	1.00	38	1.8	10.5	32	1.0
mean	18.2	1.70	51	1.2	1.02	43	1.8	11.0	35	1.4
bottom max.	20.0	1.75	53	1.3	1.15	45	1.9	12.0	90	2.4
waters min.	17.6	1.60	51	1.2	1.00	40	1.8	10.0	30	1.4
mean	18.7	1.68	52	1.2	1.05	43	1.9	10.8	52	1.9

Temperature/Dissolved Oxygen 1978 Station J4



Annual Phosphorus Supply (Kg, %)

Land Runoff	267	41.5
Atmosphere	258	40.1
Shoreline Development	118	18.4

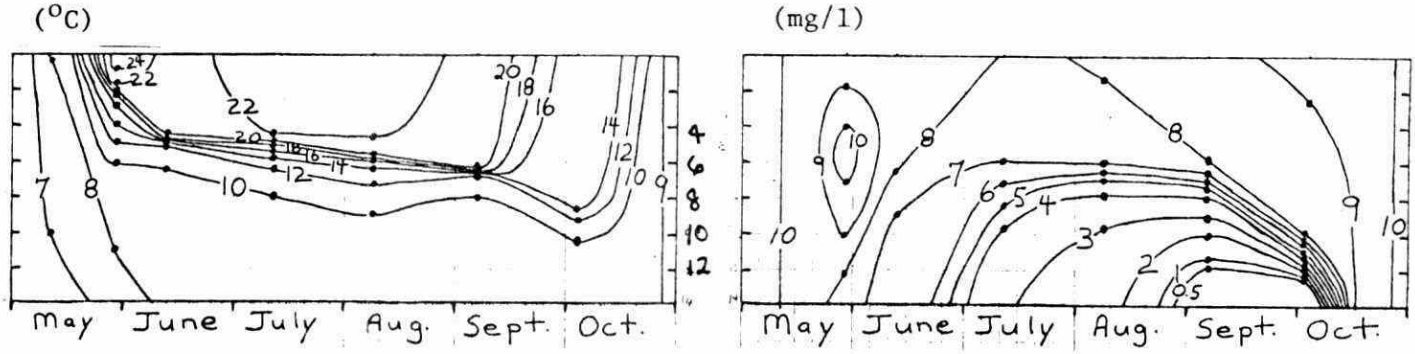
LAKE JACK (Redmond & Callahan Bay)

Chemistry 1978 (results in mg/1 unless otherwise noted) Station J5

	NH_3	TKN	NO_2	NO_3	T. P.	Tot. Org. C	Inorg. C	pH	Cond. (umhos/cm^3)
euphotic max.	0.016	0.50	0.003	0.125	0.013	6.6	11.2	7.69	117
zone min.	0.006	0.12	0.001	0.005	0.007	6.0	9.6	7.17	112
mean	0.010	0.34	0.002	0.035	0.009	6.3	10.6	7.37	114
bottom max.	0.086	0.44	0.004	0.147	0.012	6.3	13.4	7.58	120
waters min.	0.004	0.12	0.002	0.005	0.007	5.8	9.6	6.85	112
mean	0.035	0.33	0.003	0.091	0.010	6.0	11.3	7.08	116

	Ca	Mg	Hard.	Na	K	Alk.	Cl	SO_4	Colour (Hazen U.)	Turbidity (F.T.U.)
euphotic max.	19.2	1.80	55	1.2	1.05	46	1.7	11.5	25	1.7
zone min.	18.2	1.60	52	1.2	1.00	42	1.7	10.5	19	1.0
mean	18.7	1.70	54	1.2	1.02	45	1.7	11.0	23	1.3
bottom max.	19.4	1.80	56	1.2	1.10	48	2.2	11.2	49	1.9
waters min.	18.6	1.65	53	1.2	0.95	43	1.7	10.0	20	1.0
mean	19.0	1.72	54	1.2	1.02	46	1.9	10.6	30	1.3

Temperature/Dissolved Oxygen 1978 Station J5



Annual Phosphorus Supply (Kg, %)

Land Runoff	_____	_____
Atmosphere	_____	_____
Shoreline Development	_____	_____

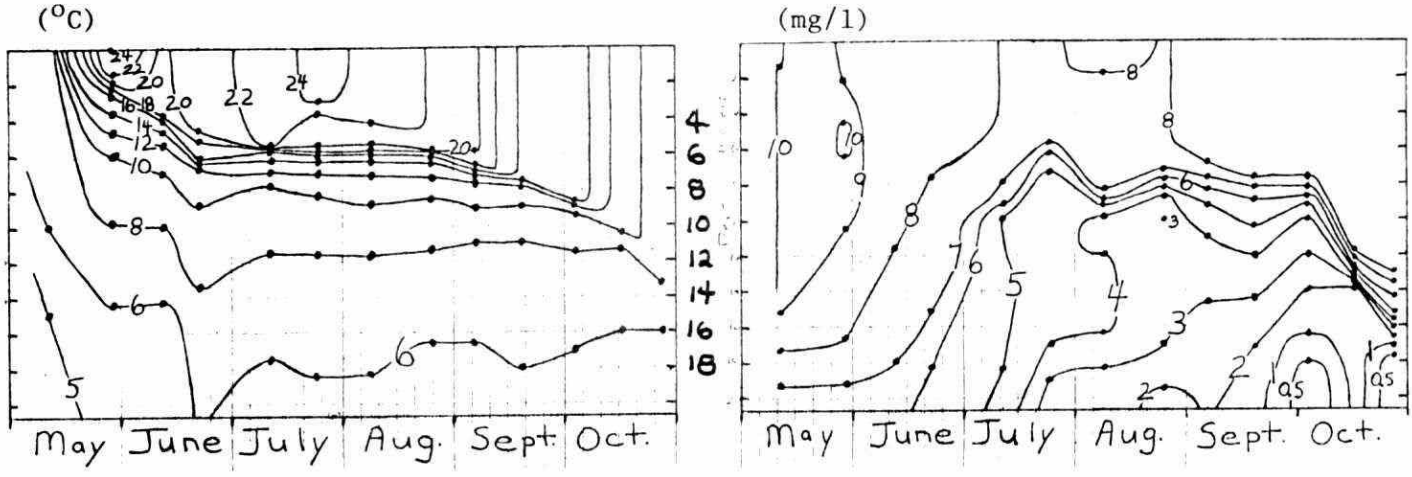
LAKE JACK

Chemistry 1978 (results in mg/l unless otherwise noted) Station J6

	NH_3	TKN	NO_2	NO_3	T. P.	Tot. Org. C	Inorg. C	pH	Cond. (umhos/cm^3)
euphotic max.	0.016	0.44	0.003	0.130	0.013	6.3	11.0	8.12	118
zone min.	0.006	0.20	0.001	0.005	0.006	6.1	9.6	7.10	112
mean	0.008	0.33	0.002	0.037	0.009	6.2	10.5	7.40	114
bottom max.	0.088	0.40	0.010	0.285	0.012	6.1	14.2	7.12	132
waters min.	0.004	0.12	0.001	0.150	0.003	5.8	12.8	6.85	118
mean	0.037	0.32	0.004	0.223	0.007	6.0	13.5	6.96	123

	Ca	Mg	Hard.	Na	K	Alk.	Cl	SO_4	Colour (Hazen U.)	Turbidity (F.T.U.)
euphotic max.	19.2	2.05	56	1.2	1.05	48	1.7	11.5	22	1.5
zone min.	18.6	1.70	53	1.2	0.95	43	1.6	10.5	18	0.6
mean	18.9	1.85	55	1.2	1.00	46	1.7	11.0	20	1.0
bottom max.	22.0	2.05	63	1.2	1.00	54	1.7	11.5	30	1.6
waters min.	19.6	1.80	56	1.1	1.00	48	1.7	9.0	18	1.5
mean	20.6	1.92	59	1.2	1.00	51	1.7	10.3	24	1.4

Temperature/Dissolved Oxygen 1978 Station J6



Annual Phosphorus Supply (Kg, %)

Land Runoff	197	40.6
Atmosphere	217	44.7
Shoreline Development	71	14.6

LAKE JACK (North Portion)

Phytoplankton 1978

(% of total volume)

	J6
Cyanophyceae	31.3
Dinophyceae	5.5
Cryptophyceae	16.0
Chrysophyceae	15.0
Bacillariophyceae	30.7
Chlorophyceae	1.4

Common Species

Aphanizomenon
Asterionella
Oscillatoria
Cryptomonas
Fragilaria

Zooplankton 1978

(% of total numbers)

	J6	J4
Calanoida	11.3	17.8
Cyclopoida	46.6	55.2
Cladocera	29.5	24.2
Nauplii	12.6	2.8

Common Species

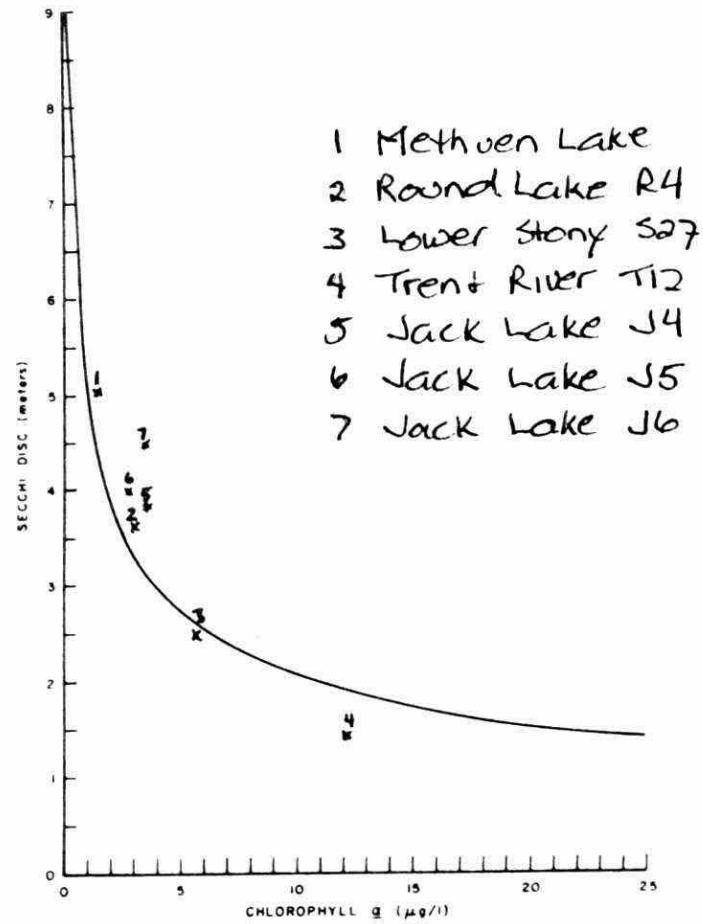
Benthos 1978

(% of total number)	early summer
Tubificidae	4.3
Chironomidae	10.4
Chaoboridae	83.5
Other	1.9
Total (Organisms/m^2	813

Common Species

Chaoborus
Limnodrilus hoffmeisteri
Kiefferulus
Procladius

Aquatic Macrophytes



1 Methven Lake
2 Round Lake R4
3 Lower Stony S27
4 Trent River T12
5 Jack Lake J4
6 Jack Lake J5
7 Jack Lake J6

Ontario

Ministry of the Environment

Central Region

Suite 700
150 Ferrand Drive
Don Mills, Ontario
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LAKE JACK (South Portion)

Township Methuen
Burleigh

County Peterborough

Joint 7 Links Planning Board - Ministry of the Environment Survey

Morphometry

Surface Area (Ao)	7.80	Km^2
Volume (V)	95.92	$x10^6 m^3$
mean depth (Z)	12.3	m
maximum depth (Zm)	43.0	m
drainage basin (Ad)	21.86	Km^2 (immediate)

Geology of basin (%)

plutonic	7
sedimentary	93
volcanic	0
limestone	0

Basin cover (%)

forested	>90
cleared	<10

Shoreline development

permanent dwellings	0
cottages	217
cottage rental units	0
campground units	0
registered undeveloped	84

Historical Record

Station J7

Year	Discharge ($x10^6 m^3/yr$)	Tot. P. (ug/l)	Chlor. a (ug/l)	S.D. (m)	Phytopl. ($mm^3 l$)	Zoopl. (No./l)	A.H.O.D. ($mg/m^2/day$)
1970							
1971							
1972							
1973							
1974			1.4	4.4			
1975							
1976			2.9	4.5			
1977				4.7			
1978	31.36	10	2.6	5.2	0.99	29	
1978	Station J9	14	3.8	4.9	0.84	20	

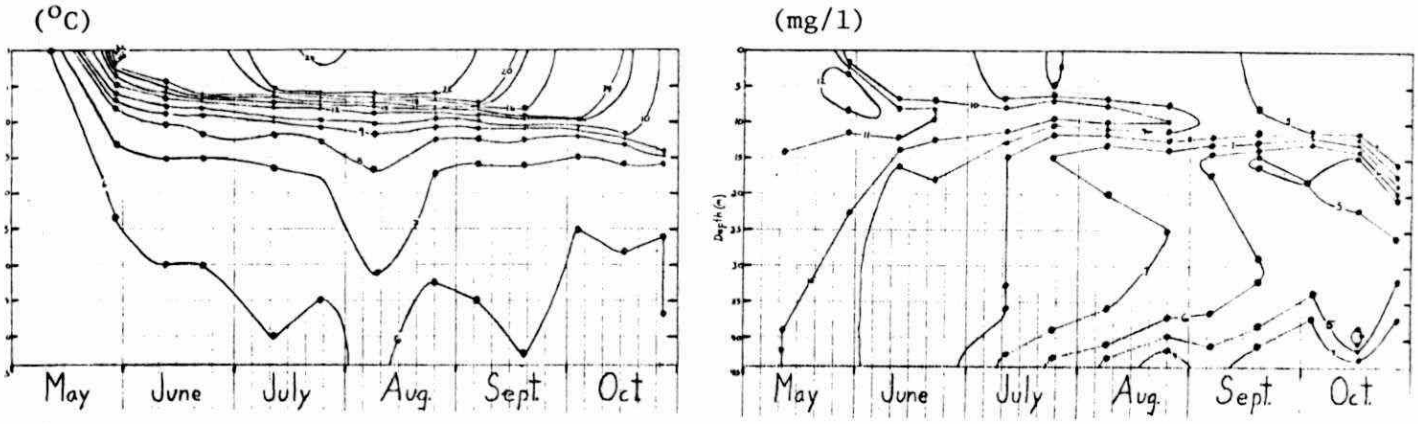
LAKE JACK

Chemistry 1978 (results in mg/l unless otherwise noted) Station J7

	NH_3	TKN	NO_2	NO_3	T. P.	Tot. Org. C	Inorg. C	pH	Cond. (umhos/cm^3)
euphotic max.	0.010	0.41	0.002	0.055	0.016	5.5	14.2	8.43	136
zone min.	0.002	0.26	0.001	0.005	0.004	4.4	12.8	7.47	131
mean	0.005	0.33	0.001	0.014	0.010	5.0	13.5	7.87	134
bottom max.	0.058	0.37	0.003	0.270	0.046	4.4	15.8	7.42	140
waters min.	0.004	0.11	0.001	0.060	0.009	4.4	13.0	7.06	132
mean	0.022	0.27	0.001	0.184	0.028	4.4	14.7	7.23	136

	Ca	Mg	Hard.	Na	K	Alk.	Cl	SO_4	Colour (Hazen U.)	Turbidity (F.T.U.)
euphotic max.	24	2.05	68	1.1	0.95	58	1.4	10.5	12	1.3
zone min.	23	1.80	65	1.0	0.90	57	1.4	9.5	3	0.7
mean	23	1.90	66	1.0	0.93	58	1.4	10.0	7	0.9
bottom max.	24	1.85	68	1.1	0.95	61	1.5	10.0	20	1.2
waters min.	23	1.70	64	1.0	0.95	58	1.4	9.0	5	0.6
mean	23	1.80	66	1.1	0.95	59	1.5	9.5	10	0.9

Temperature/Dissolved Oxygen 1978



Annual Phosphorus Supply (Kg, %)

Land Runoff	181	27.5
Atmosphere	390	59.3
Shoreline Development	87	13.2

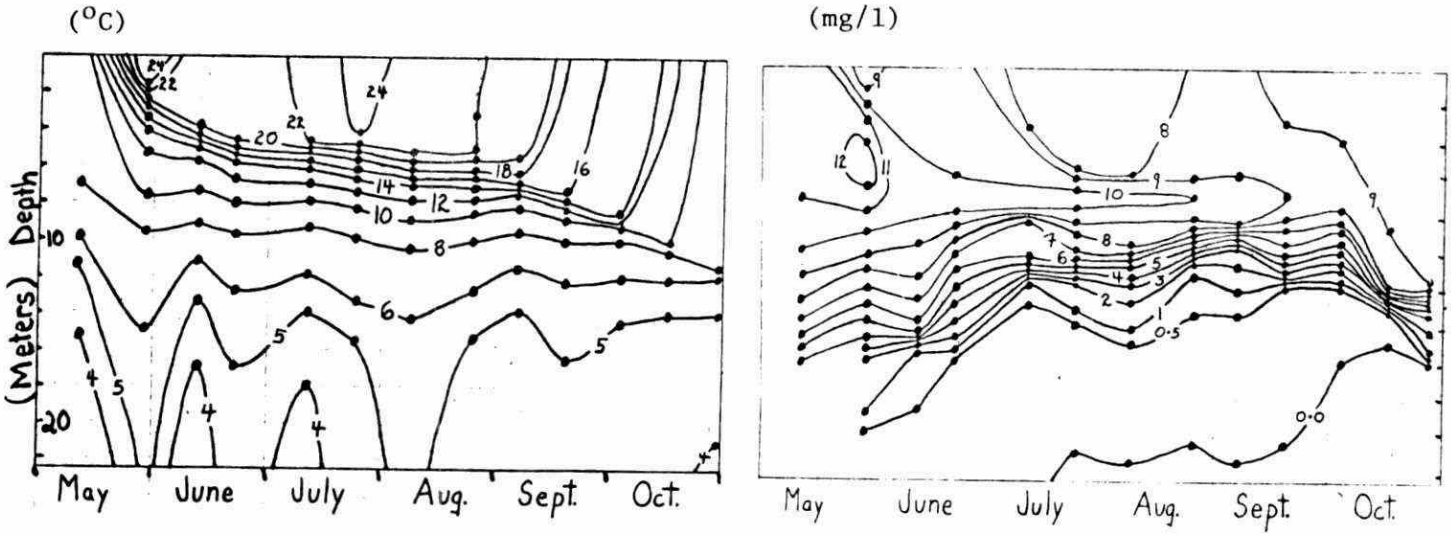
LAKE JACK

Chemistry 1978 (results in mg/l unless otherwise noted) Station J8

	NH_3	TKN	NO_2	NO_3	T. P.	Tot. Org. C	Inorg. C	pH	Cond. (umhos/cm^3)
euphotic max.	0.014	0.40	0.002	0.030	0.022	5.5	15.2	8.00	144
zone min.	0.006	0.27	0.001	0.005	0.005	4.9	10.4	7.28	136
mean	0.009	0.36	0.001	0.009	0.010	5.3	13.2	7.60	141
bottom max.	1.130	1.56	0.016	0.210	0.133	5.8	26.4	7.16	200
waters min.	0.202	0.31	0.001	0.005	0.008	5.4	22.2	6.74	190
mean	0.709	1.11	0.004	0.040	0.092	5.6	24.9	6.89	194

	Ca	Mg	Hard.	Na	K	Alk.	Cl	SO_4	Colour (Hazen U.)	Turbidity (F.T.U.)
euphotic max.	25	1.90	78	1.1	0.90	62	1.4	10.5	13	0.7
zone min.	24	1.75	67	1.0	0.80	61	1.3	10.0	5	0.1
mean	24	1.85	71	1.0	0.87	62	1.4	10.3	8	0.5
bottom max.	35	2.65	98	1.2	0.95	91	1.6	12.5	84	5.2
waters min.	32	2.55	90	1.0	0.45	61	1.3	8.5	13	1.5
mean	33	2.62	93	1.1	0.78	80	1.4	10.5	42	3.7

Temperature/Dissolved Oxygen 1978



Annual Phosphorus Supply (Kg, %)

Land Runoff	____	____
Atmosphere	____	____
Shoreline Development	____	____

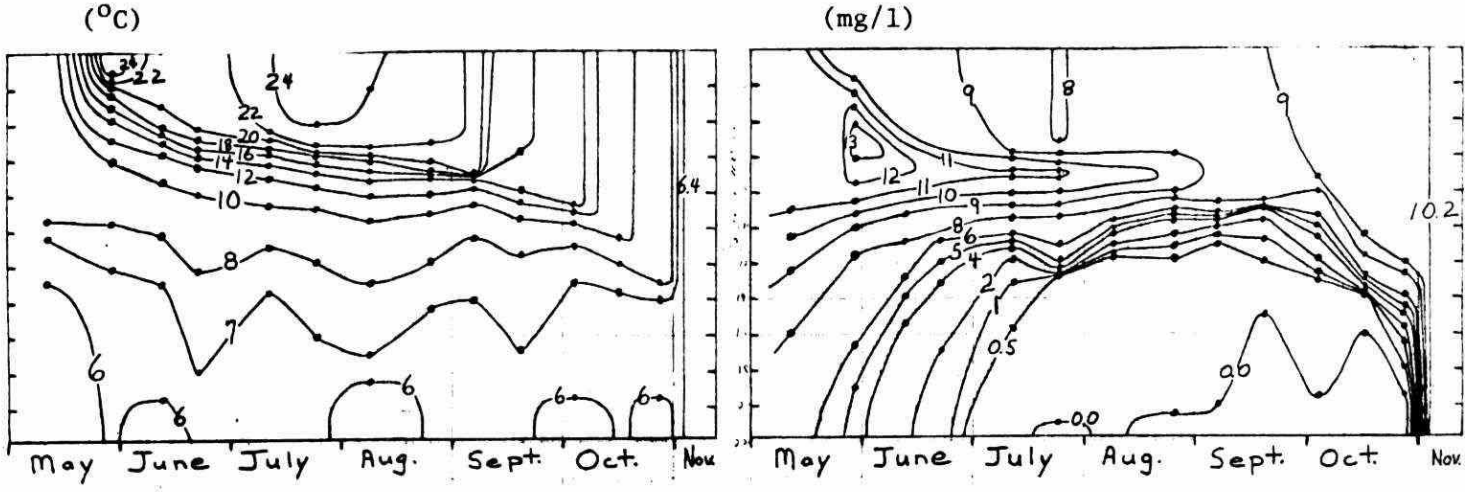
LAKE JACK

Chemistry 1978 (results in mg/l unless otherwise noted) Station J9

	NH_3	TKN	NO_2	NO_3	T. P.	Tot. Org. C	Inorg. C	pH	Cond. (umhos/cm^3)
euphotic max.	0.024	0.50	0.025	0.040	0.020	5.6	15.2	8.00	141
zone min.	0.006	0.27	0.001	0.005	0.005	4.9	13.6	7.34	134
mean	0.014	0.39	0.005	0.014	0.014	5.3	14.3	7.58	139
bottom max.	1.160	1.51	0.065	0.125	0.134	5.4	21.0	7.28	160
waters min.	0.038	0.35	0.001	0.005	0.014	4.9	14.4	6.83	144
mean	0.577	0.89	0.011	0.039	0.069	5.2	18.3	6.97	151

	Ca	Mg	Hard.	Na	K	Alk.	Cl	SO_4	Colour (Hazen U.)	Turbidity (F.T.U.)
euphotic max.	25	1.90	70	1.0	0.95	88	1.4	10.4	11	1.0
zone min.	23	1.75	65	1.0	0.90	60	1.3	9.5	5	0.7
mean	24	1.83	67	1.0	0.92	69	1.4	10.00	9	0.9
bottom max.	25	1.90	70	1.1	1.00	71	1.4	9.5	58	3.4
waters min.	25	1.75	70	1.0	0.95	61	1.3	7.5	5	1.0
mean	25	1.83	70	1.0	0.96	66	1.4	8.7	25	2.2

Temperature/Dissolved Oxygen 1978 Station J9



Annual Phosphorus Supply (Kg, %)

Land Runoff	_____	_____
Atmosphere	_____	_____
Shoreline Development	_____	_____

LAKE JACK (South Portion)

Phytoplankton 1978
(% of total volume)

	J7	J9
Cyanophyceae	17.8	14.3
Dinophyceae	9.2	12.3
Cryptophyceae	12.7	8.2
Chrysophyceae	8.4	42.7
Bacillariophyceae	38.2	20.6
Chlorophyceae	13.7	1.9

Common Species

Cyclotella
Cryptomonas
Chroococcus
Tabellaria
Aphanizomenon
Chrysosphaerella
Rhizosolenia

Zooplankton 1978
(% of total numbers)

	J7	J9
Calanoida	9.5	15.0
Cyclopoida	41.0	51.5
Cladocera	41.6	31.1
Nauplii	7.8	2.5

Common Species

Diaphanosoma leuchtenbergianum
Daphnia galeata mendotae
Bosmina sp
Daphnia dubia
Cyclops scutifer
Mesocyclops edax
Diaptomus oregonensis
Epischura lacustris

Benthos 1978
(% of total number) early

Tubificidae	27.5	____
Chironomidae	70.4	____
Chaoboridae	0	____
Other	2.1	____
Total (Organisms/m^2)	260	____

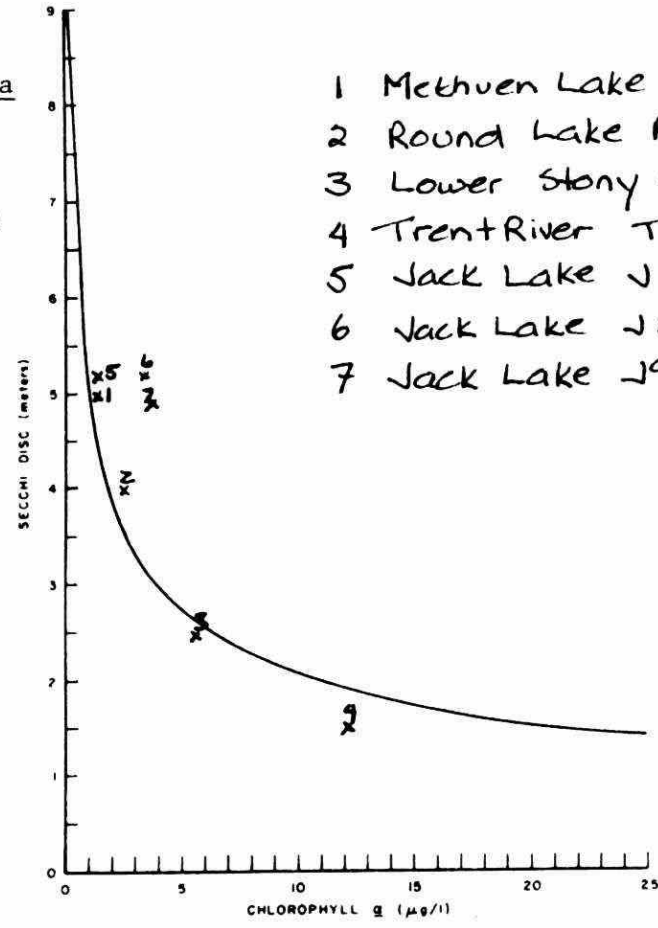
Common Species

Limnodrilus hoffmeisteri
Tanytarsini
Chironomus
Procladius

Aquatic Macrophytes

Chara sp
Nitella sp
Sparganium sp
Potamogeton amplifolius
P. epihydrus
P. gramineus
P. natans
P. oaksianus
P. pectinatus
P. praelongus
P. richardsoni
P. robbinsii
P. strictifolius
P. zosteriformis
Najas flexilis
Sagittaria sp
Elodea canadensis
Vallisneria americana
Eleocharis acicularis
Heteranthera dubia
Ceratophyllum demersum
Nuphar variegatum

Ranunculus sp
Amoracia aquatica
Myriophyllum alterniflorum
M. exalbescens
M. heterophyllum
M. tenellum
Utricularia intermedia
U. vulgaris
Megalodonta beckii



1 Methven Lake
2 Round Lake R4
3 Lower Stony S27
4 Trent River T12
5 Jack Lake J7
6 Jack Lake J8
7 Jack Lake J9

Ontario

Ministry of the Environment

Central Region

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KASSHABOG LAKE

Kasshabog Lake is located approximately 22 Kilometres (Km) north of Havelock in Methuen Township. The lake receives flow from several smaller tributary lakes. The major inflow is the North River from Methuen Lake. The lake discharges to the North River which is part of the Crowe River System. Although Kasshabog Lake has numerous islands and bays, only MacDonald Bay appeared to be hydrologically separated from the main lake. For the purposes of this report, MacDonald Bay was considered separate from and tributary to the rest of Kasshabog Lake.

The lake had about 16 permanent residences, 504 cottages and 4 cottage rental units. MacDonald Bay had 81 cottages along its shoreline. The MacDonald Bay volume flushed about twice during 1978 ($2.07\ year^{-1}$) while the remaining portion of the lake flushed about once (1.08 times per year).

Kasshabog Lake had soft, slightly acidic water with a moderately low amount of apparent colour. The hardness, alkalinity and conductivity values indicated that the main body of the lake was well mixed with the exception of Station K8, where slightly higher values were noted. MacDonald Bay also had slightly higher values for the same parameters.

Thermal stratification was noted at all lake stations with the exception of Station K11 where mixing of the water column generally reached to the bottom waters. Water clarity, as indicated by Secchi disc was moderately good throughout the lake. Clarity was probably reduced to some extent by natural colouring of the water in the euphotic zone. Based on Secchi disc measurements alone, Kasshobog Lake and MacDonald Bay were considered moderately enriched or mesotrophic.

Dissolved oxygen distribution throughout the lake including MacDonald Bay, showed a clinograde (gradually decreasing with depth) profile. This decline in dissolved oxygen in the bottom waters was probably due to the decomposition of organic matter and the oxygen demand of the sediment. At Station K9, slight maxima and minima in dissolved oxygen concentration were noted from July to September. The reason for these variations was not clear during the study.

The rate of depletion of dissolved oxygen in the bottom waters or the AHOD was calculated to be 281 mg/m^2 day at Station K9. According to limits suggested by Mortimer (1941, 1942), the Lake was considered mesotrophic.

Mean total phosphorus concentration in the surface waters of the lake stations ranged between 6 and 9 ug P.l. Based on total phosphorus concentration Kasshabog Lake was considered unenriched or oligotrophic. Although low dissolved oxygen concentrations existed in the bottom waters by late summer, no significant accumulation of nutrients in the bottom waters was noted at any of the lake stations.

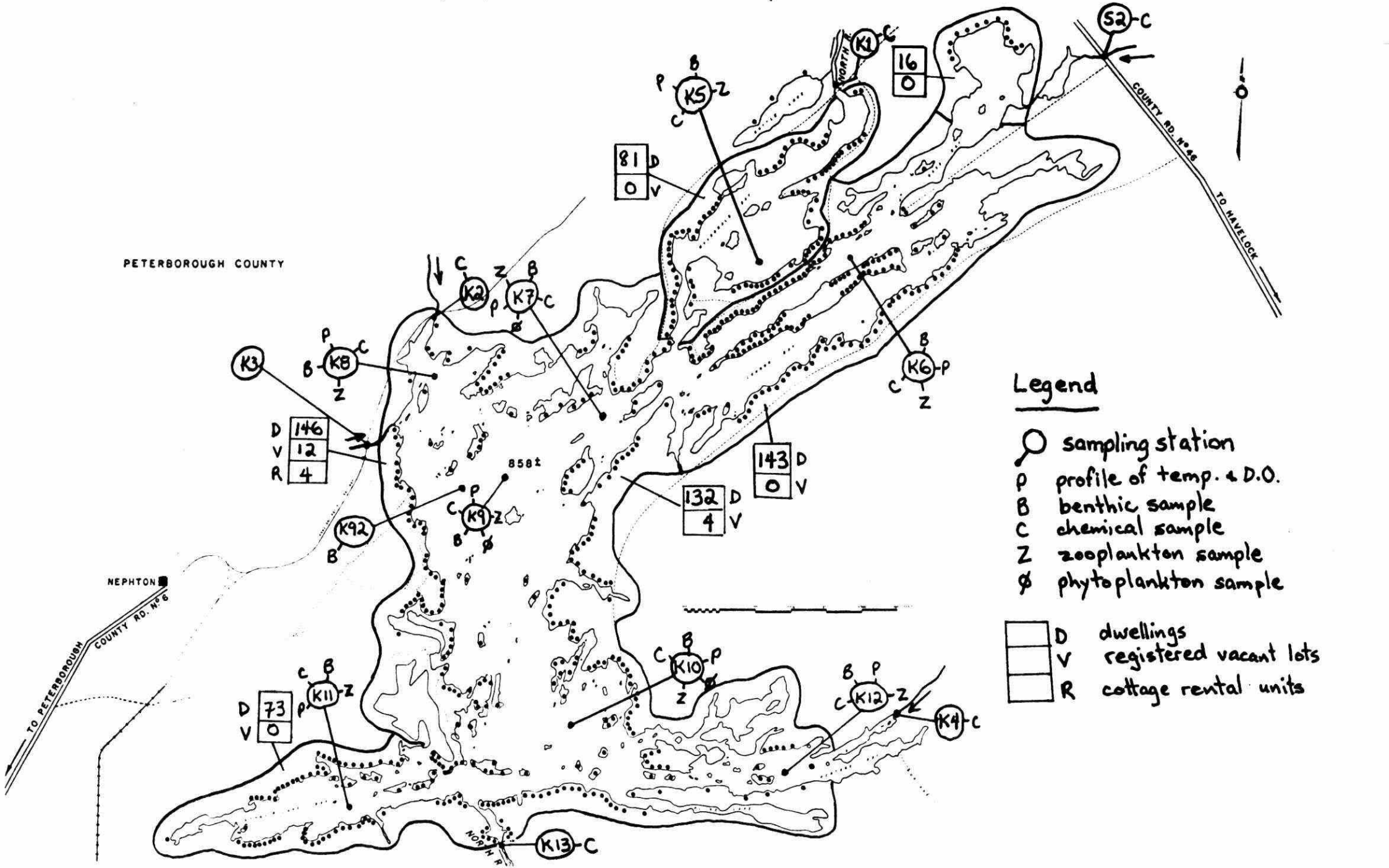
The phytoplankton community in the main lake was dominated by Chrysophyceae and Bacillariophyceae but other groups were also well represented. Phytoplankton density was favorably low. A common form in the main lake was Botryococcus which generally requires enriched conditions for growth, but other forms noted such as Cyclotella are common in unenriched water quality conditions. The density and composition of the phytoplankton community suggested unenriched conditions in the lake.

The crustacean zooplankton community in the main lake as well as in MacDonald Bay had relatively low density and was dominated by Cladocera and Cyclopoida. The community and density indicated that Kasshabog Lake was moderately enriched.

The benthic invertebrate community of the lake was dominated by Chaborus with both chironomidae and tubificidae present. All organisms found were suited to living in low dissolved oxygen concentrations. The composition and density of organisms indicated moderately enriched conditions.

In summary, Kasshabog Lake had good water quality during 1978 and was considered to be oligotrophic but bordering on mesotrophy. Any further shoreline development on the lake should be carefully planned and constructed to minimize or eliminate the addition of plant nutrients to the lake.

Kasshabog Lake Sampling Locations and Development 1978



Ontario

Ministry of the Environment

Central Region

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LAKE KASSHABOG (excluding MacDonald Bay)

Township Methuen County Peterborough

Joint 7 Links Planning Board - Ministry of the Environment Survey

Morphometry

Surface Area (Ao)	7.961	Km^2
Volume (V)	35.90	$x10^6 m^3$
mean depth (Z)	4.5	m
maximum depth (Zm)	25.3	m
drainage basin (Ad)	96.4	Km^2

Geology of basin (%)

plutonic	85
sedimentary	12
volcanic	0
limestone	3

Basin cover (%)

forested	>90
cleared	<10

Shoreline development

permanent dwellings	16
cottages	504
cottage rental units	4
campground units	0
registered undeveloped	0

Historical Record

Year	Discharge ($x10^6 m^3/yr$)	Tot. P. (ug/l)	Chlor. a (ug/l)	S.D. (m)	Phytopl. ($mm^3 l$)	Zoopl. (No./l)	A.H.O.D. ($mg/m^2/day$)
1970							
1971							
1972							
1973							
1974							
1975							
1976							
1977							
1978	38.85	(K9) 7	1.7	4.0	0.36	15	281 (417)
		(K10) 6	1.8	4.0	0.87	-	267 (344)

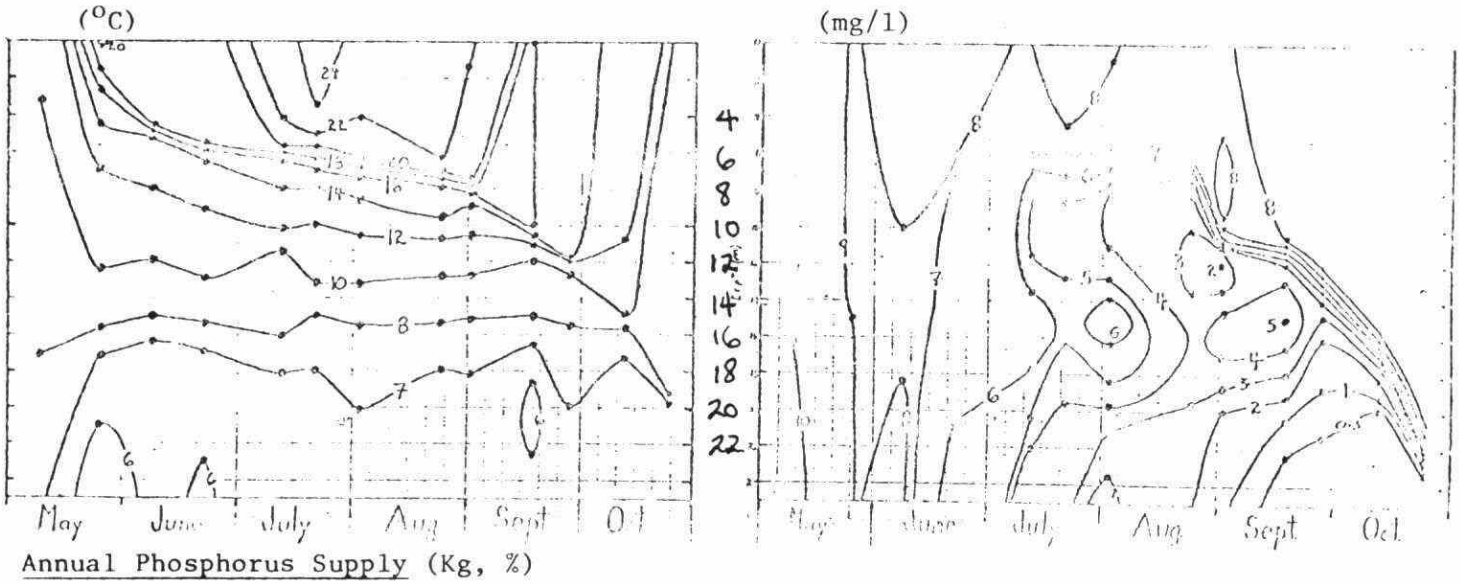
LAKE Kasshabog

Chemistry 1978 (results in mg/l unless otherwise noted) Station K9

	NH_3	TKN	NO_2	NO_3	T. P.	Tot. C	Org.	Inorg. C	pH	Cond. (umhos/cm^3)
euphotic max.	0.040	0.40	0.003	0.145	0.010	5.0		4.2	7.20	67
zone min.	0.014	0.27	0.001	0.018	0.005	4.2		4.0	6.62	58
mean	0.020	0.32	0.002	0.057	0.007	4.6		4.1	6.92	61
bottom max.	0.178	0.48	0.003	0.298	0.012	4.6		8.4	6.98	72
waters min.	0.014	0.26	0.001	0.030	0.006	3.8		4.2	6.32	62
mean	0.069	0.34	0.002	0.196	0.008	4.2		6.7	6.52	66

	Ca	Mg	Hard.	Na	K	Alk.	Cl	SO_4	Colour (Hazen U.)	Turbidity (F.T.U.)
euphotic max.	8.0	1.15	25	2.6	1.0	21	2.3	7.5	21	1.3
zone min.	6.8	1.00	21	2.2	1.0	19	1.8	6.5	13	0.8
mean	7.3	1.07	23	2.4	1.0	20	2.0	7.0	16	1.1
bottom max.	8.0	1.15	25	2.7	1.10	25	2.1	7.5	82	8.0
waters min.	7.2	1.10	23	2.3	1.00	20	1.9	6.5	10	1.1
mean	7.7	1.12	24	2.4	1.05	22	2.0	6.8	41	3.7

Temperature/Dissolved Oxygen 1978 Station K9



Annual Phosphorus Supply (Kg, %)

Land Runoff	483	44.1
Atmosphere	398	36.3
Shoreline Development	215	19.6

LAKE Kasshabog

Phytoplankton 1978
(% of total volume)

	K 9	K 10
Cyanophyceae	12.4	15.0
Dinophyceae	14.4	9.3
Cryptophyceae	11.3	12.0
Chrysophyceae	24.2	24.6
Bacillariophyceae	19.4	24.3
Chlorophyceae	18.3	14.8

Zooplankton 1978
(% of total numbers)

	K 9	K 10
Calanoida	13.9	7.3
Cyclopoida	37.4	38.5
Cladocera	44.3	51.0
Nauplii	4.4	3.2

Benthos 1978
(% of total number)

	early summer
Tubificidae	4.7
Chironomidae	20.1
Chaoboridae	74.2
Other	1.0
Total (Organisms/m^2	4784

Common Species

K9	K10
Cyclotella	Botryococcus
Cryptomonas	Cryptomonas
Chrysosphaerella	Tabellaria
Unid. chrysomonas	Dinobryon
Arthrodesmus	Coelosphaerium
Rhizosolenia	Chrysochromulina

Common Species

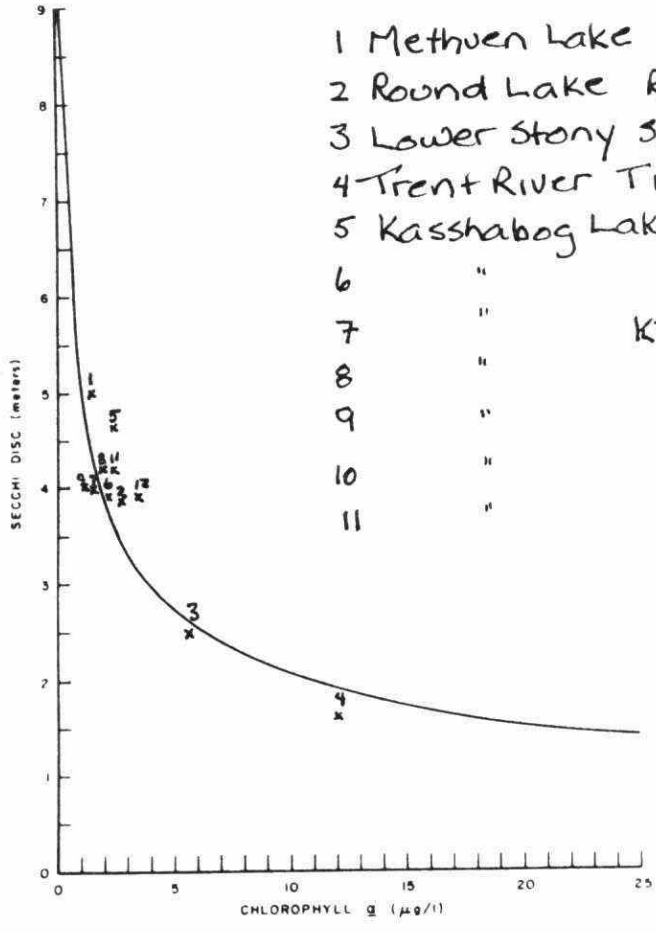
Diaphanosoma leuchtenbergianum
Holopedium gibberum
Daphnia galeata mendotae
Cyclops scutifer
Mesocyclops edax
Diaptomus oregonensis
Epischura lacustris
Senecella calanoides

Common Species

Chaoborus
Chironomus
Procladius
Kiefferulus
Limnodrilus hoffmeisteri

Aquatic Macrophytes

Chara sp.
Isoetes sp.
Sparganium sp.
Potamogeton amplifolius
P. epihydrus
P. gramineus
P. natans
P. richardsonii
P. robbinsii
P. spirillus
P. zosteriformis
Najas flexilis
Sagittaria sp.
Elodea canadensis
Vallisneria americana
Eleocharis robbinsii
Eriocaulon septangulare
Pontederia cordata
Juncus pelocarpus
Ceratophyllum demersum
Brasenia schreberi
Nuphar variegatum
Nymphaea odorata
Myriophyllum alterniflorum
M. heterophyllum
M. tenelum
Utricularia intermedia
U. vulgaris
Megalodonta beckii



1 Methven Lake
2 Round Lake R4
3 Lower Stony S27
4 Trent River T12
5 Kasshabog Lake K5
6 " K6
7 " K7 & K10
8 " K8
9 " K9
10 " K11
11 " K12

Ontario

Ministry of the Environment

Central Region

Suite 700
150 Ferrand Drive
Don Mills, Ontario
M3C 3C3
(416) 424-3000

LAKE MacDonald Bay of Kasshabog Lake

Township Methuen County Peterborough

Joint 7 Links Planning Board - Ministry of the Environment Survey

Morphometry

Surface Area (Ao)	0.946	Km^2
Volume (V)	3.12	$x10^6 m^3$
mean depth (Z)	3.3	m
maximum depth (Zm)	12.5	m
drainage basin (Ad)	16.0	Km^2

Geology of basin (%)

plutonic	
sedimentary	
volcanic	
limestone	

Basin cover (%)

forested	>90
cleared	<10

Shoreline development

permanent dwellings	0
cottages	81
cottage rental units	0
campground units	0
registered undeveloped	0

Historical Record

Station K5

Year	Discharge ($x10^6 m^3/yr$)	Tot. P. (ug/l)	Chlor. a (ug/l)	S.D. (m)	Phytopl. ($mm^3 l$)	Zoopl. (No./l)	A.H.O.D. ($mg/m^2/day$)
1970							
1971							
1972							
1973							
1974							
1975							
1976							
1977							
1978	6.46	7	2.2	4.6	-	15	285 (296)

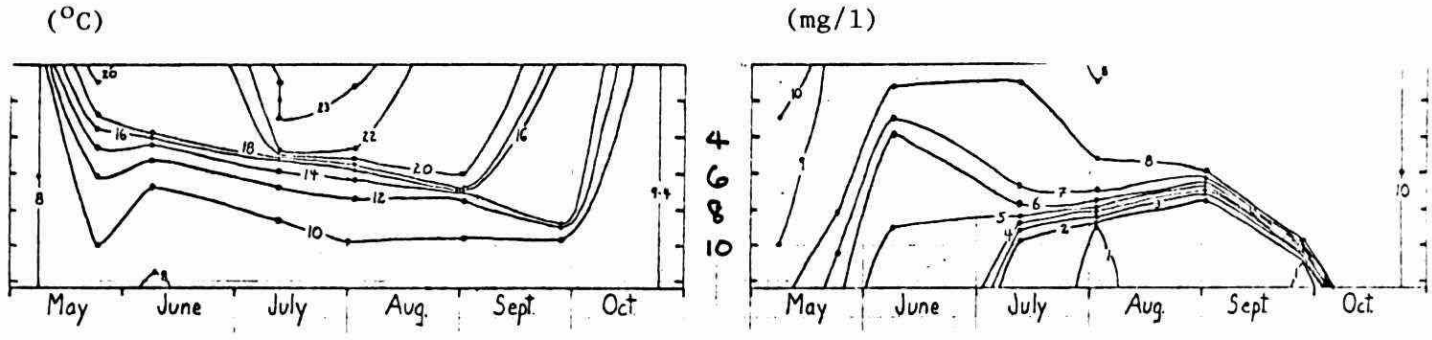
LAKE MacDonald Bay of Kasshabog Lake

Chemistry 1978 (results in mg/l unless otherwise noted) Station K5

	NH_3	TKN	NO_2	NO_3	T. P.	Tot. Org. C	Inorg. C	pH	Cond. (umhos/cm^3)
euphotic max.	0.020	0.33	0.002	0.100	0.011	5.3	6.6	7.22	76
zone min.	0.006	0.25	0.001	0.005	0.004	3.8	5.8	6.75	70
mean	0.014	0.30	0.001	0.029	0.007	4.4	6.3	6.96	74
bottom max.	0.292	0.59	0.003	0.100	0.013			6.91	82
waters min.	0.014	0.24	0.001	0.005	0.003			6.48	68
mean	0.102	0.36	0.002	0.053	0.008	4.4	6.2	6.69	74

	Ca	Mg	Hard.	Na	K	Alk.	Cl	SO_4	Colour (Hazen U.)	Turbidity (F.T.U.)
euphotic max.	9.6	1.40	30	3.1	1.25	29	1.4	8.0	26	1.5
zone min.	8.4	1.30	26	2.7	1.00	23	1.2	7.0	25	0.65
mean	8.9	1.37	28	2.9	1.12	27	1.3	7.5	25	1.1
bottom max.										
waters min.										
mean	8.4	1.38	26	2.7	1.20	26	1.3	7.8	19	0.95

Temperature/Dissolved Oxygen 1978 Station K5



Annual Phosphorus Supply (Kg, %) For MacDonald Bay

Land Runoff	57	41.9
Atmosphere	47	34.6
Shoreline Development	32	23.5

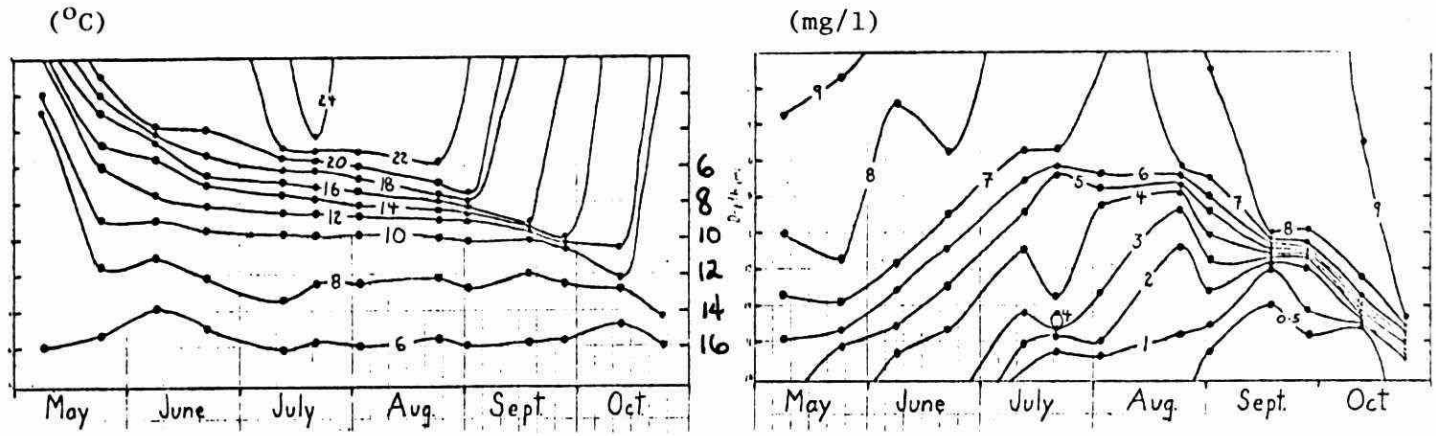
LAKE Kasshabog

Chemistry 1978 (results in mg/l unless otherwise noted) Station K6

	NH_3	TKN	NO_2	NO_3	T. P.	Tot. Org. C	Inorg. C	pH	Cond. (umhos/cm^3)
euphotic max.	0.054	0.37	0.003	0.095	0.012	5.2	4.0	7.08	58
zone min.	0.006	0.29	0.001	0.015	0.002	4.6	3.2	6.60	47
mean	0.022	0.34	0.002	0.039	0.007	4.9	3.7	6.70	55
bottom max.	0.336	0.67	0.004	0.287	0.015	6.2	8.0	6.49	62
waters min.	0.082	0.39	0.001	0.015	0.008	5.1	5.6	6.09	53
mean	0.167	0.48	0.002	0.126	0.013	5.5	6.8	6.23	57

	Ca	Mg	Hard.	Na	K	Alk.	Cl	SO_4	Colour (Hazen U.)	Turbidity (F.T.U.)
euphotic max.	6.8	1.05	21	2.4	0.95	18	1.8	7.0	40	1.5
zone min.	4.8	0.85	15	2.0	0.90	13	1.6	6.5	18	0.9
mean	6.1	0.95	19	2.2	0.93	16	1.7	6.8	26	1.2
bottom max.	6.2	1.05	21	2.2	1.00	28	1.9	7.5	86	5.3
waters min.	6.0	1.00	19	2.0	1.00	16	1.6	6.0	50	1.1
mean	6.1	1.03	20	2.1	1.00	20	1.8	6.7	70	3.4

Temperature/Dissolved Oxygen 1978 Station K6



Annual Phosphorus Supply (Kg, %)

Land Runoff	____	____
Atmosphere	____	____
Shoreline Development	____	____

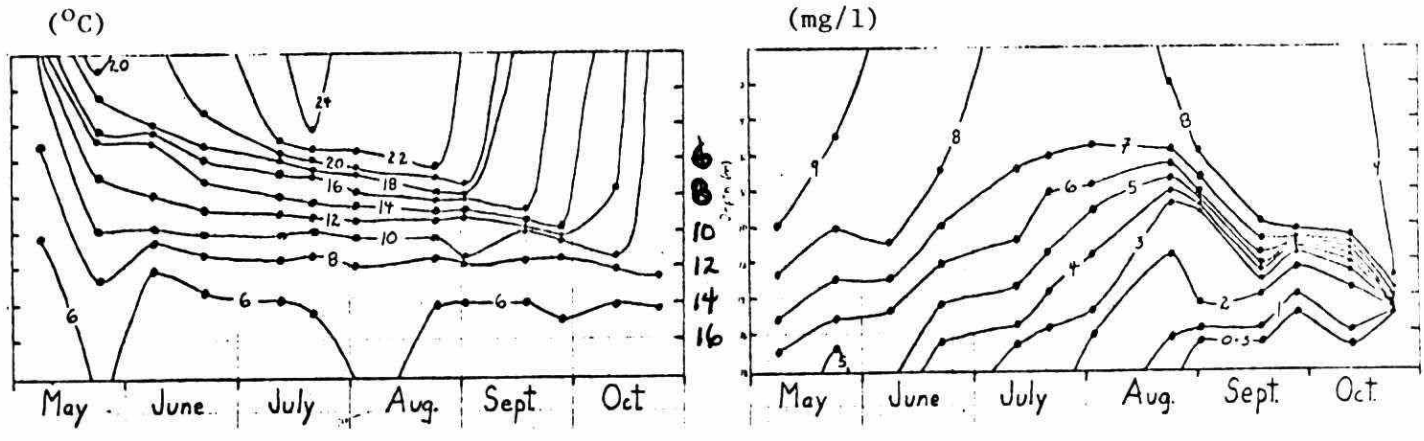
LAKE Kasshabog

Chemistry 1978 (results in mg/l unless otherwise noted) Station K7

		NH_3	TKN	NO_2	NO_3	T. P.	Tot. Org. C	Inorg. C	pH	Cond. (umhos/cm^3)
euphotic zone	max.	0.052	0.38	0.003	0.125	0.010	5.1	4.2	7.23	60
	min.	0.010	0.28	0.001	0.020	0.005	4.3	3.5	6.46	48
	mean	0.020	0.33	0.002	0.054	0.007	4.7	3.8	6.82	56
bottom waters	max.									
	min.									
	mean									

		Ca	Mg	Hard.	Na	K	Alk.	Cl	SO_4	Colour (Hazen U.)	Turbidity (F.T.U.)
euphotic zone	max.	6.8	1.05	21	2.5	0.95	21	1.8	7.0	35	1.20
	min.	5.2	0.90	17	2.0	0.85	14	1.5	6.5	14	0.65
	mean	6.3	0.98	19	2.2	0.92	18	1.7	6.8	23	0.90
bottom waters	max.										
	min.										
	mean										

Temperature/Dissolved Oxygen 1978 Station K7



Annual Phosphorus Supply (Kg, %)

Land Runoff	____	____
Atmosphere	____	____
Shoreline Development	____	____

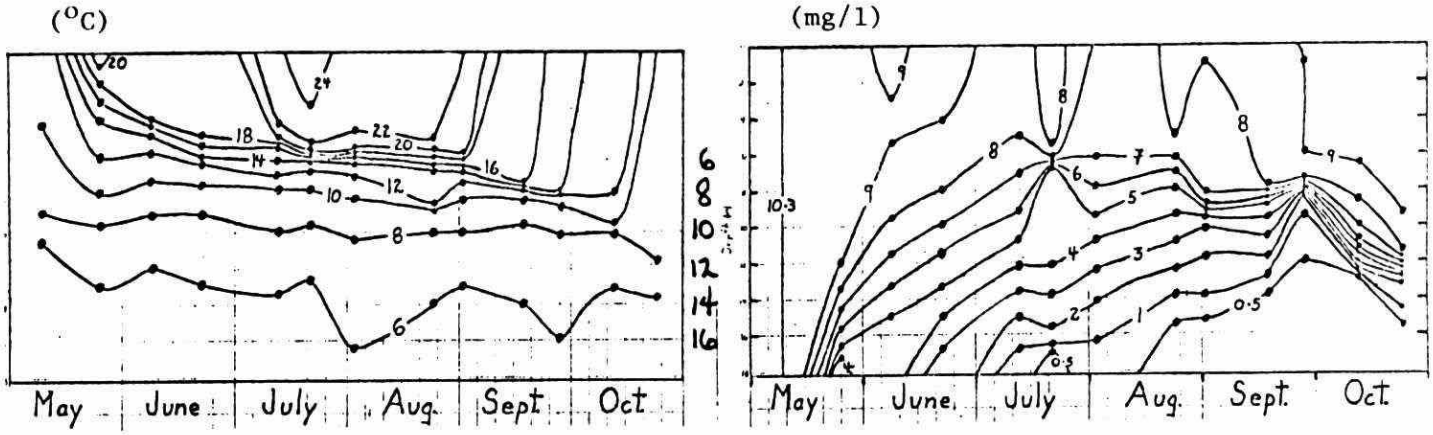
LAKE Kasshabog

Chemistry 1978 (results in mg/l unless otherwise noted) Station K8

		NH_3	TKN	NO_2	NO_3	T. P.	Tot. Org. C	Inorg. C	pH	Cond. (umhos/cm^3)
euphotic zone	max.	0.034	0.33	0.003	0.135	0.010	4.8	4.6	7.00	72
	min.	0.010	0.27	0.001	0.028	0.002	4.2	4.2	6.71	58
	mean	0.018	0.31	0.002	0.067	0.006	4.5	4.4	6.81	63
bottom waters	max.	0.366	0.64	0.013	0.273	0.032	5.6	13.4	6.86	113
	min.	0.036	0.32	0.002	0.010	0.005	3.8	4.4	6.44	73
	mean	0.126	0.46	0.005	0.167	0.014	4.5	9.5	6.61	102

		Ca	Mg	Hard.	Na	K	Alk.	Cl	SO_4	Colour (Hazen U.)	Turbidity (F.T.U.)
euphotic zone	max.	8.6	1.20	26	2.8	1.05	23	2.8	7.5	21	1.1
	min.	6.8	1.05	21	2.3	0.95	21	1.9	7.0	10	0.7
	mean	7.7	1.10	24	2.6	1.02	22	2.4	7.2	15	1.0
bottom waters	max.	13.4	1.40	39	4.5	1.50	43	5.3	7.5	73	1.9
	min.	8.8	1.20	27	2.9	1.05	23	2.9	6.0	15	1.1
	mean	11.9	1.32	35	3.7	1.32	34	4.5	7.0	46	1.5

Temperature/Dissolved Oxygen 1978 Station K8



Annual Phosphorus Supply (Kg, %)

Land Runoff	____	____
Atmosphere	____	____
Shoreline Development	____	____

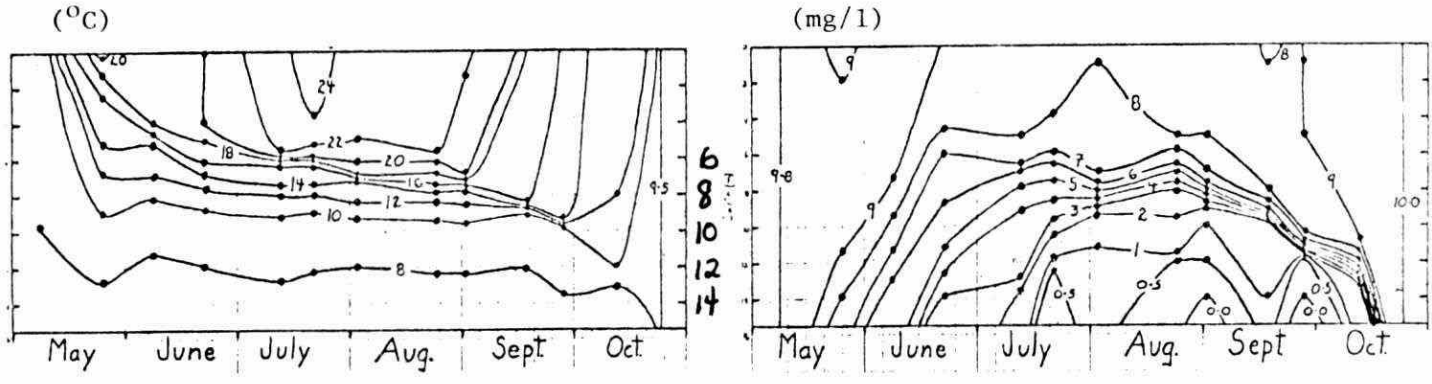
LAKE Kasshabog

Chemistry 1978 (results in mg/l unless otherwise noted) Station K10

	NH_3	TKN	NO_2	NO_3	T. P.	Tot. C	Org.	Inorg. C	pH	Cond. (umhos/cm^3)
euphotic max.	0.054	0.44	0.003	0.140	0.009	4.9		4.6	7.13	61
zone min.	0.012	0.24	0.001	0.013	0.003	4.0		3.6	6.47	54
mean	0.026	0.34	0.002	0.051	0.006	4.4		4.1	6.87	58
bottom max.	0.600	1.00	0.003	0.248	0.018	4.9		11.7	7.43	72
waters min.	0.068	0.31	0.001	0.005	0.005	4.0		8.0	6.19	61
mean	0.200	0.50	0.002	0.114	0.011	4.4		9.5	6.61	55

	Ca	Mg	Hard.	Na	K	Alk.	Cl	SO_4	Colour (Hazen U.)	Turbidity (F.T.U.)
euphotic max.	7.0	1.00	22	2.5	1.00	20	1.8	7.0	26	1.4
zone min.	6.2	1.00	20	2.0	0.85	16	1.5	6.0	12	0.8
mean	6.7	1.00	21	2.2	0.93	18	1.7	6.7	21	1.1
bottom max.	9.0	1.05	27	2.3	1.00	25	1.7	7.0	101	7.3
waters min.	6.4	1.00	20	2.0	0.90	17	1.5	5.0	16	0.65
mean	7.5	1.00	23	2.1	1.00	20	1.6	6.3	47	2.9

Temperature/Dissolved Oxygen 1978 Station K10



Annual Phosphorus Supply (Kg, %)

Land Runoff	_____	_____
Atmosphere	_____	_____
Shoreline Development	_____	_____

LAKE Kasshabog

Chemistry 1978 (results in mg/l unless otherwise noted) Station 11

		NH_3	TKN	NO_2	NO_3	T. P.	Tot. Org. C	Inorg. C	pH	Cond. (umhos/cm^3)
euphotic zone	max.	0.046	0.41	0.002	0.135	0.007	4.9	4.2	7.14	60
	min.	0.014	0.30	0.001	0.008	0.005	3.6	3.8	6.56	54
	mean	0.028	0.34	0.002	0.051	0.006	4.3	4.0	6.91	58
bottom waters	max.									
	min.									
	mean									

		Ca	Mg	Hard.	Na	K	Alk.	Cl	SO_4	Colour (Hazen U.)	Turbidity (F.T.U.)
euphotic zone	max.	7.0	1.05	22	2.5	1.00	19	1.9	7.0	24	1.00
	min.	6.2	0.90	19	2.0	0.85	16	1.5	7.0	15	0.65
	mean	6.7	0.98	21	2.2	0.93	18	1.7	7.0	18	0.90
bottom waters	max.										
	min.										
	mean										

Temperature/Dissolved Oxygen 1978

(^oC) (mg/l)

non-stratified

at or near saturation throughout sampling period

Annual Phosphorus Supply (Kg, %)

Land Runoff	____	____
Atmosphere	____	____
Shoreline Development	____	____

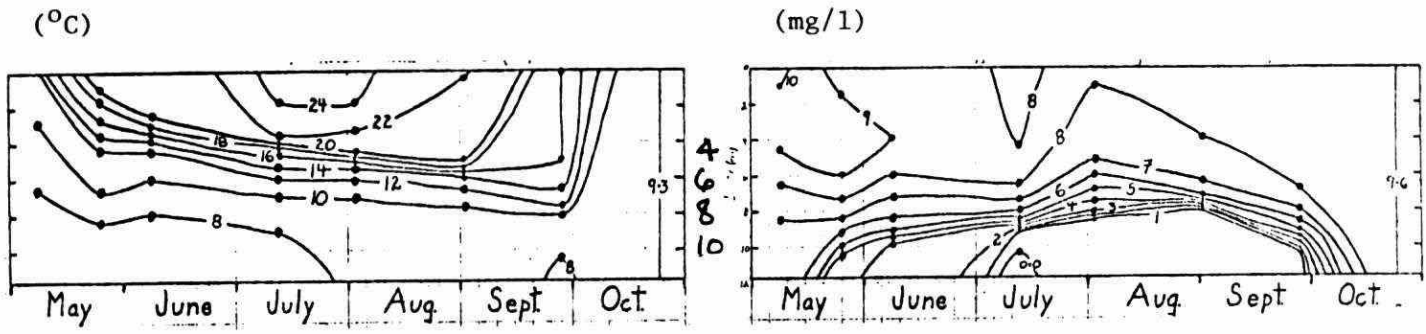
LAKE Kasshabog

Chemistry 1978 (results in mg/l unless otherwise noted) Station K12

	NH_3	TKN	NO_2	NO_3	T. P.	Tot. Org. C	Inorg. C	pH	Cond. (umhos/cm^3)
euphotic max.	0.080	0.43	0.004	0.070	0.013	5.0	4.4	6.93	58
zone min.	0.014	0.32	0.001	0.005	0.006	4.4	3.6	6.56	49
mean	0.037	0.38	0.002	0.024	0.009	4.6	4.1	6.76	56
bottom max.	1.050	1.60	0.003	0.140	0.023			6.94	78
waters min.	0.050	0.35	0.001	0.005	0.006			6.25	52
mean	0.362	0.73	0.002	0.049	0.013	4.8	4.4	6.40	60

	Ca	Mg	Hard.	Na	K	Alk.	Cl	SO_4	Colour (Hazen U.)	Turbidity (F.T.U.)
euphotic max.	6.8	1.05	21	2.3	0.95	20	1.7	7.0	35	1.1
zone min.	5.8	0.95	18	1.4	0.70	14	1.1	6.0	23	0.9
mean	6.5	1.00	20	1.9	0.85	18	1.5	6.5	28	1.0
bottom max.										
waters min.										
mean	6.5	1.00	20	1.7	0.80	18	1.4	6.8	28	1.2

Temperature/Dissolved Oxygen 1978 Station K2



Annual Phosphorus Supply (Kg, %)

Land Runoff	____	____
Atmosphere	____	____
Shoreline Development	____	____

Ontario

Ministry of the Environment

Central Region

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Don Mills, Ontario
M3C 3C3
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LONG LAKE

Long Lake is located about 17 Km north west of the Village of Havelock in Methuen Township. The lake receives flow from a few unnamed streams and flows to the North River immediately upstream of South Lake. The lake had four cottages along its shoreline during 1978. A moderately high flushing rate was calculated for the lake (4.45 yr^{-1}) but this rate was due to the small lake volume rather than a high inflow.

Long Lake had hard alkaline water with moderately low apparent colour. Water clarity as indicated by Secchi disc was moderate with a mean value of 3.7 metres. Based on this value alone, the lake was considered moderately enriched or mesotrophic.

Some thermal stratification was noted in the water column at Station L2 during the survey.

The dissolved oxygen distribution was clinograde (gradually decreasing within the bottom waters with depth). With a minimum value of 2 mg/l during the survey. The decline in dissolved oxygen concentration was probably due to the decomposition of organic matter accumulating in the bottom waters and the sediment oxygen demand.

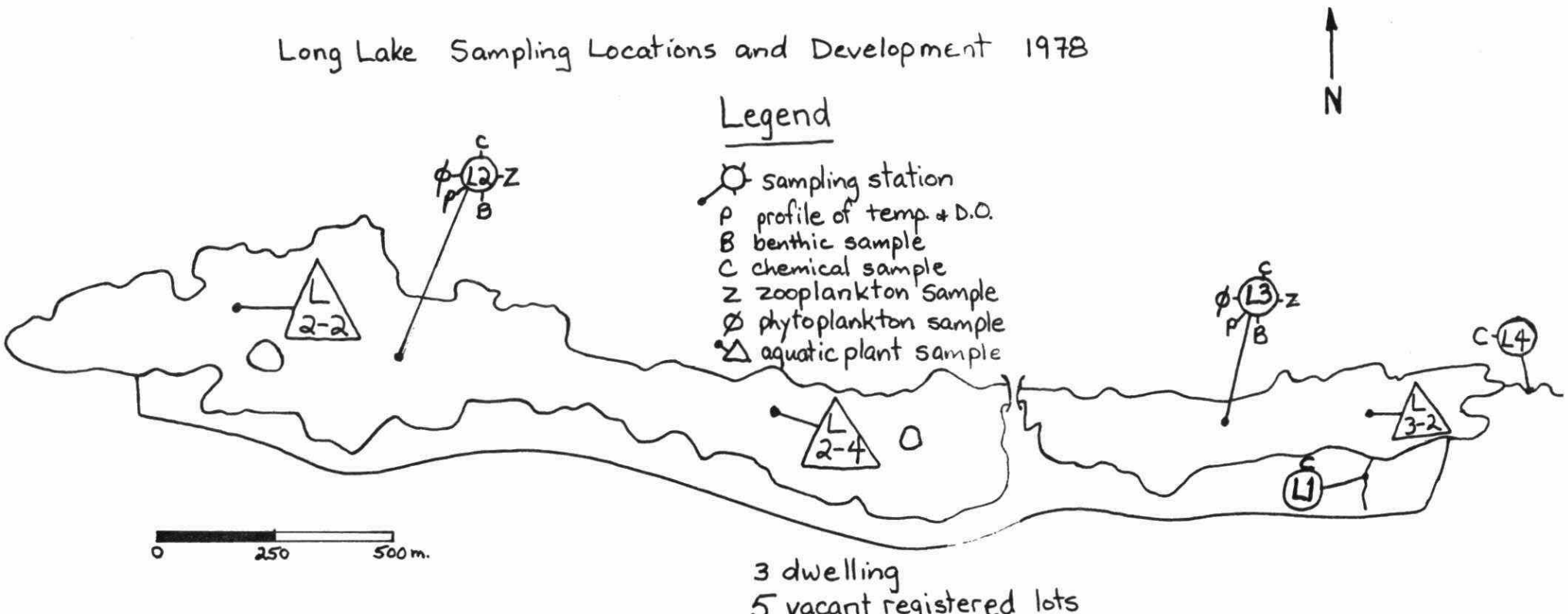
Total phosphorus concentration in the euphotic zone of the lake was moderately low and indicated oligotrophic or unenriched conditions. Phytoplankton density was moderately low with a very even balance in dominance between the major phytoplankton groups. Based on phytoplankton density and composition, the lake was considered mesotrophic or moderately enriched.

The crustacean zooplankton community was dominated by Cladocera. Both community composition and the relatively high density suggested that the lake was moderately enriched or mesotrophic.

The benthic invertebrate community was dominated by Chaoborus at Station L2. This organism is well suited to living in low dissolved oxygen conditions. The community at Station at L3 was dominated by chironomidae that are typically found in a more shallow waters.

Long Lake was characterized by moderate water quality conditions and was considered mesotrophic or moderately enriched. The lake was considered moderately sensitive to further unrestricted shoreline development.

Long Lake Sampling Locations and Development 1978



3 dwelling
5 vacant registered lots

Ontario

Ministry of the Environment

Central Region

Suite 700
150 Ferrand Drive
Don Mills, Ontario
M3C 3C3
(416) 424-3000

LAKE LONG

Township County

Joint 7 Links Planning Board - Ministry of the Environment Survey

Morphometry

Surface Area (Ao)	0.598	Km^2
Volume (V)	1.149	$x10^6 m^3$
mean depth (Z)	1.9	m
maximum depth (Zm)	8.2	m
drainage basin (Ad)	12.7	Km^2

Geology of basin (%)

plutonic	90
sedimentary	10
volcanic	
limestone	

Basin cover (%)

forested	100
cleared	

Shoreline development

permanent dwellings	0
cottages	4
cottage rental units	0
campground units	0
registered undeveloped	7

Historical Record

Year	Discharge ($x10^6 m^3/yr$)	Tot. P. (ug/l)	Chlor. a (ug/l)	S.D. (m)	Phytopl. ($mm^3 l$)	Zoopl. (No./l)	A.H.O.D. ($mg/m^2/day$)
1970							
1971							
1972							
1973							
1974							
1975							
1976							
1977							
1978	5.12	10	2.8	3.7	0.69	42	

LAKE LONG

Chemistry 1978 (results in mg/l unless otherwise noted) Station L2

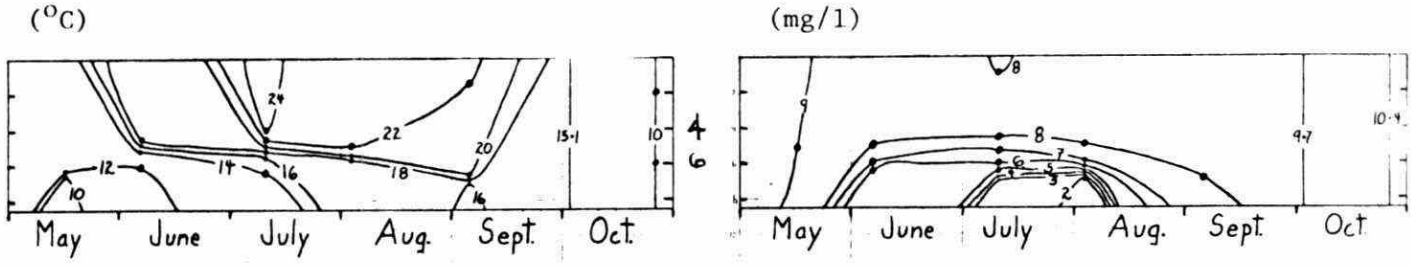
		NH_3	TKN	NO_2	NO_3	T. P.	Tot. Org. C	Inorg. C	pH	Cond. (umhos/cm^3)
euphotic zone	max.	0.020	0.46	0.004	0.015	0.014	6.5	30.4	8.29	276
	min.	0.006	0.33	0.001	0.005	0.006	5.0	24.2	7.61	220
	mean	0.012	0.39	0.002	0.007	0.010	6.0	26.5	7.95	239
bottom waters	max.									
	min.									
	mean									

euphotic zone usually reached bottom waters

		Ca	Mg	Hard.	Na	K	Alk.	Cl	SO_4	Colour (Hazen U.)	Turbidity (F.T.U.)
euphotic zone	max.	47	7.0	146	1.9	0.75	124	6.2	13.0	15	0.70
	min.	31	6.5	104	1.8	0.75	100	5.8	12.0	10	0.65
	mean	37	6.8	120	1.9	0.75	109	6.1	12.5	13	0.70
bottom waters	max.										
	min.										
	mean										

euphotic zone usually reached bottom waters

Temperature/Dissolved Oxygen 1978



Annual Phosphorus Supply (Kg, %)

Land Runoff	70	69
Atmosphere	30	29
Shoreline Development	1.6	2

LAKE LONG

Chemistry 1978 (results in mg/l unless otherwise noted) Station L3

		NH_3	TKN	NO_2	NO_3	T. P.	Tot. Org. C	Inorg. C	pH	Cond. (umhos/cm^3)
euphotic zone	max.	0.026	0.49	0.004	0.020	0.013	6.6	30.0	8.30	265
	min.	0.006	0.31	0.001	0.005	0.005	4.7	23.4	7.80	200
	mean	0.015	0.42	0.002	0.010	0.008	5.9	25.9	8.12	226
bottom waters	max.									
	min.			euphotic zone usually reached bottom waters						
	mean									

		Ca	Mg	Hard.	Na	K	Alk.	Cl	SO_4	Colour (Hazen U.)	Turbidity (F.T.U.)
euphotic zone	max.	48	6.0	145	1.7	0.70	124	4.9	12.5	22	0.60
	min.	32	5.5	103	1.6	0.65	98	4.4	10.5	14	0.50
	mean	38	5.8	118	1.6	0.68	107	4.7	11.8	19	0.60
bottom waters	max.										
	min.			euphotic zone usually reached bottom waters							
	mean										

Temperature/Dissolved Oxygen 1978

(^oC) (mg/l)

Annual Phosphorus Supply (Kg, %)

Land Runoff	____	____
Atmosphere	____	____
Shoreline Development	____	____

LAKE LONG

Phytoplankton 1978
(% of total volume)

Cyanophyceae	15.1
Dinophyceae	12.3
Cryptophyceae	20.7
Chrysophyceae	26.4
Bacillariophyceae	22.0
Chlorophyceae	3.5

Common Species

Cryptomonas
Stephanodiscus
Dinobryon
Cyclotella
Oscillatoria

Zooplankton 1978
(% of total numbers)

Calanoida	14.4
Cyclopoida	34.6
Cladocera	48.7
Nauplii	1.6

Common Species

Daphnia retrocurva
Diaphanosoma leuchtenbergianum
Holopedium gibberum
Mesocyclops edax
Cyclops scutifer
Diaptomus oregonensis

Benthos 1978

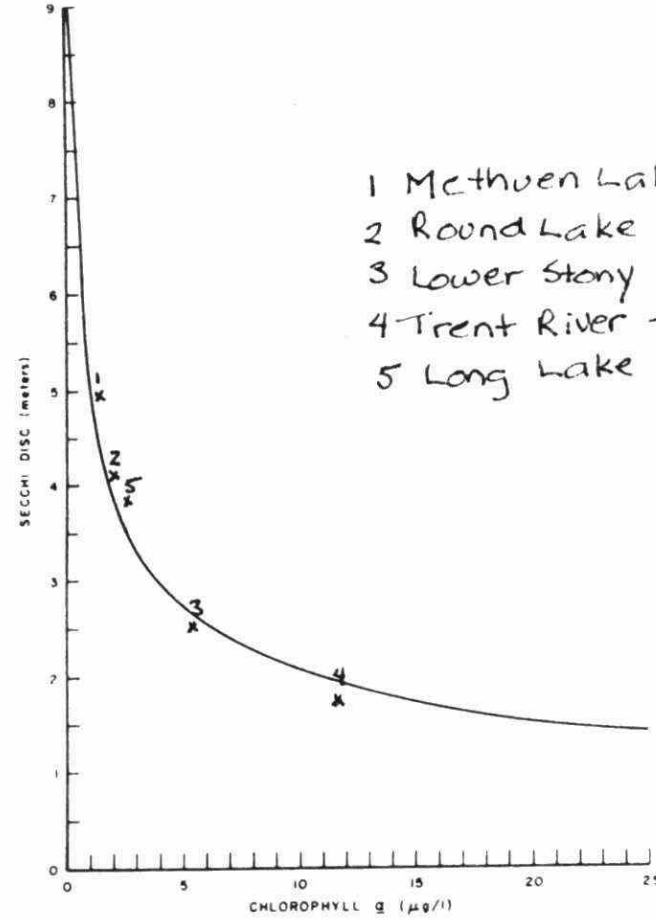
(% of total number)	L2	L3
Tubificidae	0	0
Chironomidae	0	77.9
Chaoboridae	100	16.9
Other	0	5.2
Total (Organisms/m^2	57	2947

Common Species

Chironomini
Polypedilium
Chaoborus

Aquatic Macrophytes

Chara sp
Potamogeton amplifolius
P. gramineus
P. illinoensis
P. natans
P. pectinatus
P. praelongus
P. richardsonii
P. robbinsii
P. zosteriformis
Najas flexilis
Sagittaria sp
Elodea canadensis
Vallisneria americana
Heteranthera dubia
Myriophyllum alterniflorum
M. exalbescens
M. heterophyllum
Utricularia vulgaris



1 Methven Lake
2 Round Lake R4
3 Lower Stony 527
4 Trent River T12
5 Long Lake

Ontario

Ministry of the Environment

Central Region

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LOST LAKE

Lost Lake is located about 14 Km north of the Village of Havelock. The lake receives drainage from a relatively small watershed which has volcanic bedrock geology and discharges to an unnamed creek flowing into the Crowe River just upstream of Belmont Lake. There was one rental cottage and one campsite along the shoreline of the lake during 1978. The lake had a relatively low flushing rate ($0.26\ yr^{-1}$).

The lake had moderately hard, alkaline water with a relatively low amount of apparent colour. Water clarity as indicated by Secchi disc was moderately good with a mean value of 4.4 m. Based on this parameter alone, Lost Lake was considered moderately enriched.

Thermal stratification was noted at Station L5 during the survey.

The dissolved oxygen distribution showed a slight maximum in concentration in the euphotic zone during June. The distribution was clinograde for the remainder of the sampling period. The maximum in concentration may have been caused by the production of phytoplankton inhabiting that layer of water. The gradual decline in concentration with depth was probably the result of the decomposition of organic material accumulating in the bottom waters and the sediment oxygen demand.

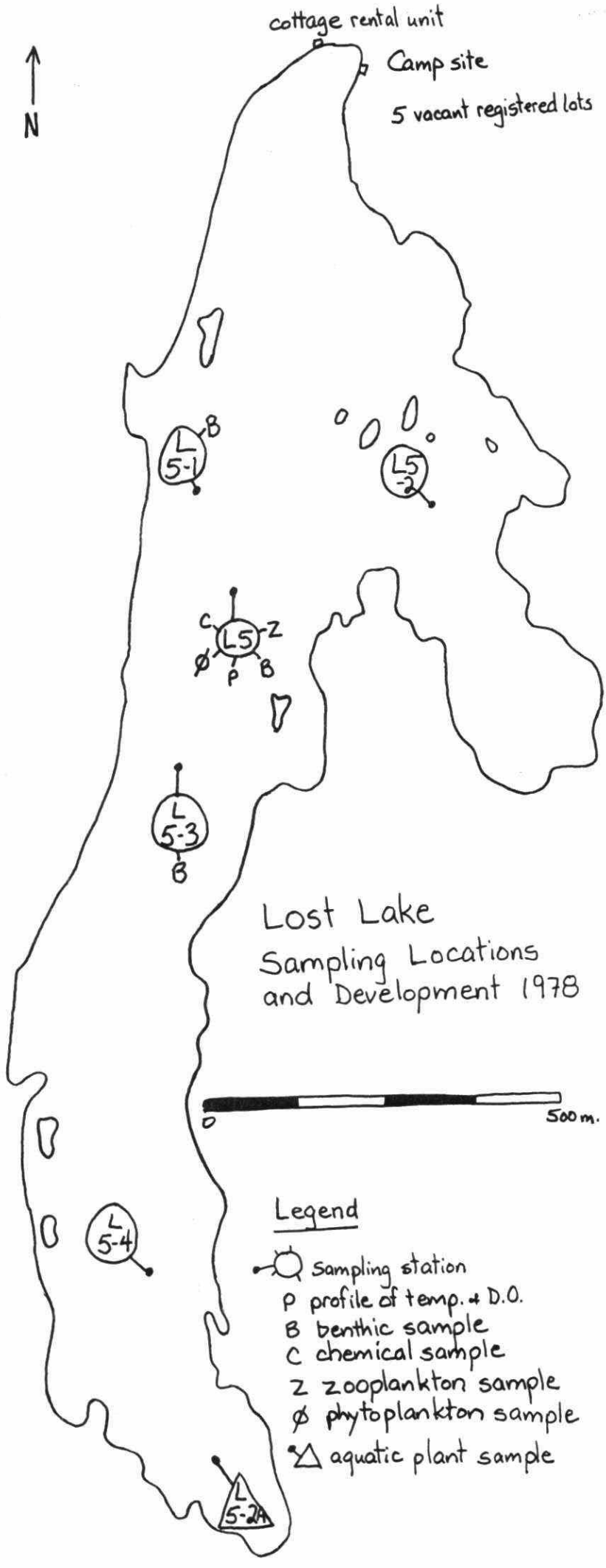
Mean total phosphorus concentration in the euphotic zone was moderately high. Based on this parameter, the lake was considered mesotrophic or moderately enriched.

Phytoplankton density in the euphotic zone was moderately high. The dominant groups at the lake station were Chrysophyceae and Bacillariophyceae. Based on phytoplankton density and composition, the lake was considered moderately enriched or mesotrophic.

The crustacean zooplankton community was dominated by Cladocera. Both density and community composition indicated that the lake was moderately enriched.

Benthic invertebrate density in the lake was low with a dominance of Chaodorus and clams of the family sphaeridae. Based on benthos density, the lake was considered unenriched.

Lost Lake was characterized by moderately good water quality and was considered moderately enriched or mesotrophic. In view of the low flushing rate, the lake was considered sensitive to further unrestricted shoreline development.


cottage rental unit
Camp site
5 vacant registered lots
N
L 5-1
B
L5-2
C
Z
L5
Ø
P
B
L 5-3
B
Lost Lake
Sampling Locations
and Development 1978
500 m.
Legend
sampling station
P profile of temp. & D.O.
B benthic sample
C chemical sample
Z zooplankton sample
Ø phytoplankton sample
aquatic plant sample
L 5-4
L 5-2A

Ontario

Ministry of the Environment

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LAKE LOST

Township County

Joint 7 Links Planning Board - Ministry of the Environment Survey

Morphometry

Surface Area (Ao)	0.656	Km^2
Volume (V)	2.581	$x10^6 m^3$
mean depth (Z)	3.9	m
maximum depth (Zm)	10.4	m
drainage basin (Ad)	1.373	Km^2

Geology of basin (%)

plutonic	
sedimentary	
volcanic	100
limestone	

Basin cover (%)

forested	100
cleared	

Shoreline development

permanent dwellings	0
cottages	0
cottage rental units	1
campground units	1
registered undeveloped	6

Historical Record

Year	Discharge ($x10^6 m^3/yr$)	Tot. P. (ug/l)	Chlor. a (ug/l)	S.D. (m)	Phytopl. ($mm^3 l$)	Zoopl. (No./l)	A.H.O.D. ($mg/m^2/day$)
1970							
1971							
1972							
1973							
1974							
1975							
1976							
1977							
1978	0.67	16	3.9	4.4	0.94	71	

LAKE LOST

Chemistry 1978 (results in mg/l unless otherwise noted)

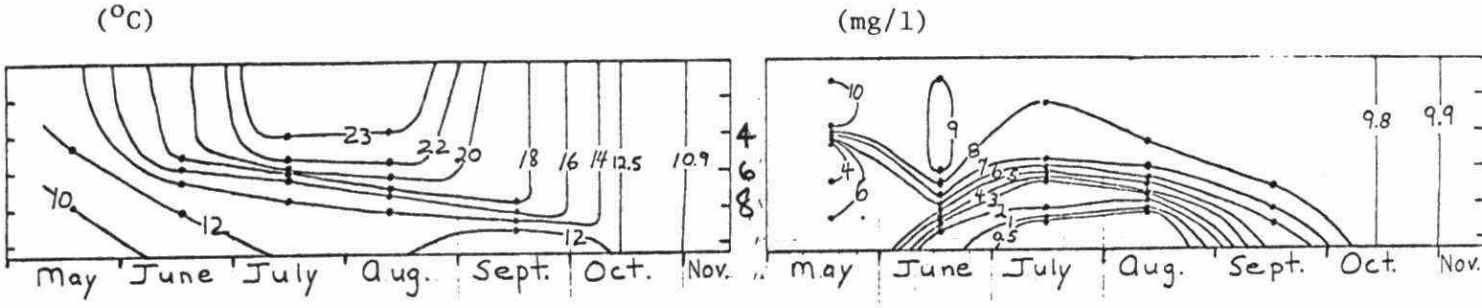
	NH_3	TKN	NO_2	NO_3	T. P.	Tot. Org. C	Inorg. C	pH	Cond. (umhos/cm^3)
euphotic zone max.	0.088	0.60	0.005	0.030	0.024	4.8	10.8	7.83	102
euphotic zone min.	0.008	0.25	0.001	0.005	0.008	3.6	8.6	7.14	94
euphotic zone mean	0.047	0.43	0.002	0.014	0.016	4.3	9.4	7.45	98
bottom waters max.									
bottom waters min.									
bottom waters mean									

euphotic zone usually reached bottom waters

	Ca	Mg	Hard.	Na	K	Alk.	Cl	SO_4	Colour (Hazen U.)	Turbidity (F.T.U.)
euphotic zone max.	16.4	1.45	47	0.7	0.60	42	0.7	8.5	16.0	1.4
euphotic zone min.	15.6	1.40	45	0.6	0.55	38	0.7	7.5	5.0	0.6
euphotic zone mean	15.9	1.43	46	0.7	0.58	40	0.7	8.0	10.0	1.0
bottom waters max.										
bottom waters min.										
bottom waters mean										

euphotic zone usually reached bottom waters

Temperature/Dissolved Oxygen 1978 Station L5



Annual Phosphorus Supply (Kg, %)

Land Runoff	13	28
Atmosphere	33	71
Shoreline Development	0.6	1

LAKE LOST

Phytoplankton 1978
(% of total volume)

Cyanophyceae	3.3
Dinophyceae	3.9
Cryptophyceae	16.0
Chrysophyceae	37.3
Bacillariophyceae	31.1
Chlorophyceae	8.4

Common Species

Tabellaria
Dinobryon
Cryptomonas
unid. chrysomonads
Fragilaria

Zooplankton 1978
(% of total numbers)

Calanoida	17.4
Cyclopoida	38.4
Cladocera	45.0
Nauplii	2.8

Common Species

Daphnia dubia
Daphnia galeata mendotae
Daphnia retrocurva
Diaphanosoma leuchtenbergianum
Diaptomus oregonensis
Mesocyclops edax
Cyclops scutifer

Benthos 1978
(% of total number)

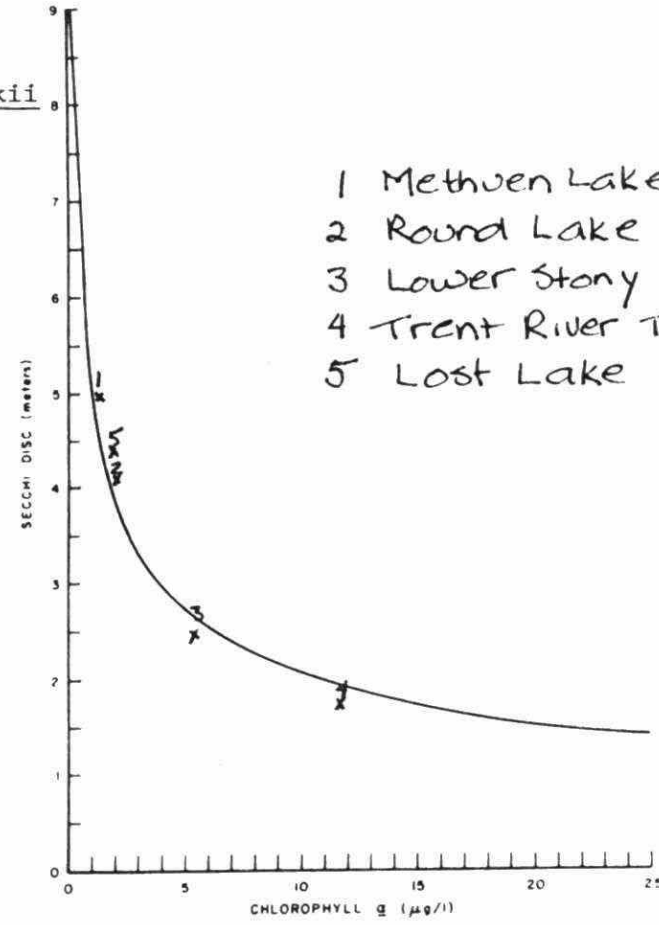
Tubificidae	0	0
Chironomidae	4.8	0
Chaoboridae	42.9	100
Other	52.9	0
Total (Organisms/m^2	76	96

Common Species

Chaoborus
sphaeridae
Chironomus

Aquatic Macrophytes

Chara sp
Potamogeton amplifolius
P. epihydrus
P. friesii
P. gramineus
P. illinoensis
P. praelongus
P. pusillus
P. richardsonii
P. robbinsii
P. strictifolius
P. zosteriformis
Najas flexilis
Sagittaria sp.
Elodea canadensis
Eleocharis acicularis
E. robbinsii
Scirpus subterminalis
Cala palustris
Potederia cordata
Heteranthera dubia
Ceratophyllum demersum
Brasenia schreberi
Nymphaea odorata
Myriophyllum spicatum
Utricularia intermedia
U. vulgaris
Megalodonta beckii



1 Methven Lake
2 Round Lake R4
3 Lower Stony S27
4 Trent River T12
5 Lost Lake

Ontario

Ministry of the Environment

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METHUEN LAKE

Methuen Lake is located about 32 Km north west of the Village of Havelock in Methuen Township. The lake has two major inflows and drains to the North River about 7 Km upstream of Kasshabog Lake.

There were 77 cottages on the lake shoreline during 1978. The lake flushing rate was moderate at about 2 times during 1978.

Methuen Lake had soft, slightly alkaline water with a moderately low amount of apparent colour. Water clarity as measured by Secchi disc was good with a mean value of 5.0 metres. Based on Secchi disc alone, the Lake was considered unenriched or oligotrophic.

Thermal stratification was noted at the lake station during the sampling period, but because of the shape and depth of the lake basin the stratification was broken up by mid-September.

Dissolved oxygen distribution in the lake water column was clinograde (gradually decreasing within the bottom waters with depth) with a minimum bottom water concentration of about 2 mg/l. The reduction in bottom water D.O. concentration was probably due to the decomposition of accumulating organic material and sediment oxygen demand.

The mean Total Phosphorus concentration in the euphotic zone was very low indicating that the lake was unenriched or oligotrophic. No accumulation of nutrients was noted in the bottom waters during the survey.

Phytoplankton densities in the euphotic zone of the lake were low during 1978. Bacillariophyceae (Diatoms) dominated the community but other groups were also well established. The common forms noted are found in a wide range of water quality conditions. Based on phytoplankton density, Methuen Lake was considered unenriched.

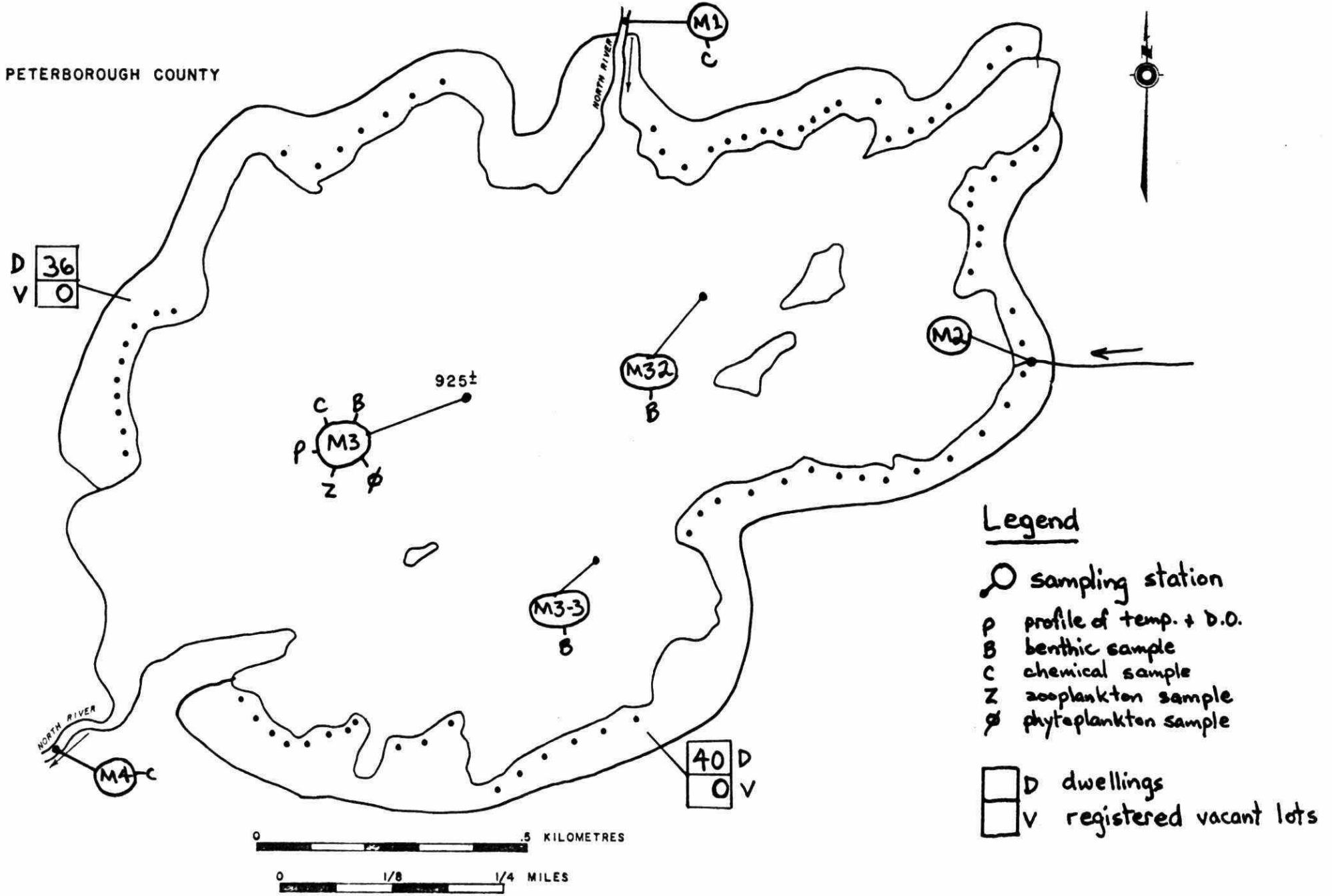
The crustacean zooplankton community in the open lake was dominated by Calanoida. This group normally dominates the open waters of unenriched lakes. Density was moderately high. Based on zooplankton density and composition the lake was considered moderately enriched.

The benthic invertebrate community in the deep lake sediments was dominated by Chaoborus with low total organism densities. Based on benthos density and composition, the lake was considered unenriched or oligotrophic.

Historically, there appeared to be no trend in the three years of Secchi disc and chlorophyll a data for the lake. Continued participation in the chlorophyll a/Secchi disc Self-Help Program is encouraged.

In summary, Methuen Lake was found to have very good water quality during 1978 and was considered oligotrophic or unenriched. The lake was considered moderately sensitive to further unrestricted shoreline development because of the moderate flushing rate and the balanced biological cummunities in the lake.

Methuen Lake Sampling Locations and Development 1978



Ontario

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Central Region

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LAKE METHUEN

Township County

Joint 7 Links Planning Board - Ministry of the Environment Survey

Morphometry

Surface Area (Ao)	1.315	Km^2
Volume (V)	5.32	$x10^6 m^3$
mean depth (Z)	4.0	m
maximum depth (Zm)	14	m
drainage basin (Ad)	22.590	Km^2

Geology of basin (%)

plutonic	85
sedimentary	15
volcanic	
limestone	

Basin cover (%)

forested	100
cleared	

Shoreline development

permanent dwellings	0
cottages	77
cottage rental units	0
campground units	0
registered undeveloped	0

Historical Record

Year	Discharge ($x10^6 m^3/yr$)	Tot. P. (ug/l)	Chlor. a (ug/l)	S.D. (m)	Phytopl. ($mm^3 l$)	Zoopl. (No./l)	A.H.O.D. ($mg/m^2/day$)
1970							
1971							
1972							
1973							
1974			1.9	5.4			
1975							
1976			1.8	4.5			
1977							
1978	9.10	4	1.5	5.0	0.26	24	

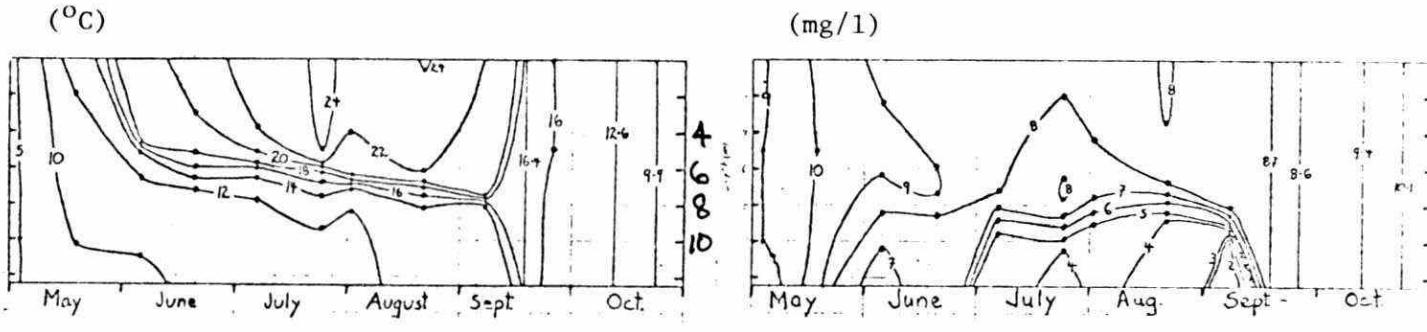
LAKE METHUEN

Chemistry 1978 (results in mg/l unless otherwise noted)

		NH_3	TKN	NO_2	NO_3	T. P.	Tot. Org. C	Inorg. C	pH	Cond. (umhos/cm^3)
euphotic zone	max.	0.030	0.030	0.002	0.070	0.005	4.4	7.5	7.50	77
	min.	0.006	0.23	0.001	0.005	0.003	3.3	6.5	6.89	72
	mean	0.019	0.26	0.001	0.024	0.004	3.9	6.9	7.26	74
bottom waters	max.									
	min.			euphotic zone usually reached bottom waters						
	mean									

		Ca	Mg	Hard.	Na	K	Alk.	Cl	SO_4	Colour (Hazen U.)	Turbidity (F.T.U.)
euphotic zone	max.	10.6	2.00	35	0.9	0.90	31	0.7	7.5	12	1.10
	min.	9.6	1.85	32	0.8	0.65	27	0.6	7.0	10	0.55
	mean	10.1	1.92	33	0.9	0.67	29	0.6	7.3	11	0.78
bottom waters	max.										
	min.			euphotic zone usually reached bottom waters							
	mean										

Temperature/Dissolved Oxygen 1978



Annual Phosphorus Supply (Kg, %)

Land Runoff	124	56.1
Atmosphere	66	29.9
Shoreline Development	31	14.0

LAKE METHUEN

Phytoplankton 1978
(% of total volume)

Cyanophyceae	14.8
Dinophyceae	6.4
Cryptophyceae	12.1
Chrysophyceae	12.1
Bacillariophyceae	48.5
Chlorophyceae	6.1

Common Species

Stephanodiscus
Fragilaria
Cryptomonas
Coelosphaerium

Zooplankton 1978
(% of total numbers)

Calanoida	41.6
Cyclopoida	24.4
Cladocera	32.7
Nauplii	1.3

Common Species

Diaptomus oregonensis
Daphnia galeata mendotae
Diaphanosoma leuchtenbergianum
Holopedium gibberum
Epischura lacustris
Cyclops scutifer

Benthos 1978
(% of total number)

Tubificidae	2.5	0
Chironomidae	6.6	11.5
Chaoboridae	91.0	85.7
Other	0	2.8
Total (Organisms/m^2	1837	670

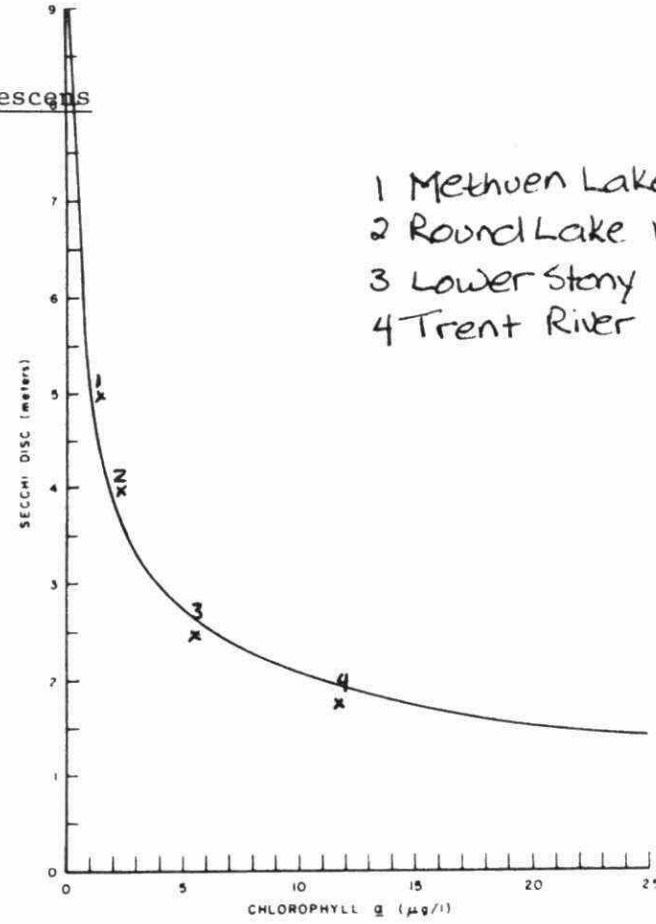
Common Species

Chaoborus
Chironomus
Procladius
unid. Tubificid

Aquatic Macrophytes

Chara sp
Nitella
Sparganium
Potamogeton amplifolius
P. epihydrus
P. gramineus
P. illinoensis
P. natans
P. praelongus
P. pusillus
P. robbinsii
P. spirillus
Najas flexilis
Sagittaria sp
Elodea canadensis
Eleocharis acicularis
Scirpus subterminalis
Eriocaulon septangulare
Pontederia cordata
Juncus militaris
J. pelocarpus
Brasenia schreberi
Nuphar variegatum
Nymphea odorata

Ranunculus sp.
Myriophyllum exalbescens
M. heterophyllum
Utricularia
intermedia
U. vulgaris
Lobelia dortmanna
Megalodonta beckii
Hypericum boreale



1 Methuen Lake
2 Round Lake R4
3 Lower Stony S27
4 Trent River T12

Ontario

Ministry of the Environment

Central Region

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OAK LAKE

Oak Lake is located about 24 kilometres north of the Village of Havelock in Methuen Township. The Lake has one main inflow and flows out to an unnamed stream flowing into South Lake of the North River system.

The lake shoreline has 4 permanent residences, 113 cottages, and 13 cottage rental units. The lake flushing was low about 0.2 yr^{-1} in 1978.

Oak Lake had moderately hard, alkaline water with a moderate amount of apparent colour. Water clarity as indicated by Secchi disc measurements was good with a mean value of 4.9 metres. Based on Secchi disc the lake was considered on the border between oliogtrophy and mesotrophy.

Thermal stratification was noted at the lake station from early May to late October, 1978.

The dissolved oxygen distribution showed a maximum in dissolved oxygen concentration within the thermocline and upper hypolimnion from mid June to mid August. Bottom water concentrations gradually declined with depth through the sampling period to a minimum of less than 0.5 mg/l. The maximum was probably the result of a production of dissolved oxygen by phytoplankton inhabiting that layer of the water column. A maximum of dissolved oxygen in the thermocline is commonly found in mesotrophic lakes. This decline was probably caused by the decomposition of accumulating organic material in the bottom waters. The rate of depletion of oxygen in the bottom waters or the areal hypolimnetic oxygen demand was calculated as 477 mg/m^2 day. According to limits suggested by Mortimer (1941, 1942) the Lake was considered eutrophic.

The mean total phosphorus concentration in the euphotic zone during the survey was favorably low indicating that the lake was unenriched or oligotrophic. The accumulation of nutrients in the bottom waters was noted during the summer. Although there does not appear to be any water quality concern at present, with a significant increase in organic decomposition in the bottom waters, the dissolved oxygen depletion will be aggravated and significantly higher concentrations of total phosphorus may accumulate in the bottom waters. This accumulated phosphorus may become available for phytoplankton growth in future years.

Ontario

Ministry of the Environment

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SANDY LAKE

Sandy Lake is located about 29 km north of the Village of Havelock in Methuen Township. The lake received drainage from a relatively small watershed and flows out to Kasshabog Lake via an unnamed creek. The lake has only two cottages along its shoreline. The moderately high flushing rate for the lake (3.7 yr^{-1}) is due to the small lake volume.

Sandy Lake had very soft acidic water with a high amount of apparent colour. Water clarity as indicated by Secchi disc was poor with an average value of 1.8 metres. The poor water clarity was probably due in part to the colour in the water as well as phytoplankton. Based on the mean Secchi disc value alone, the lake was considered enriched or eutrophic.

Thermal stratification was not noted during the survey indicating that the water column was well mixed from surface to bottom.

Dissolved oxygen was at or near saturation through the water column at all sampling dates.

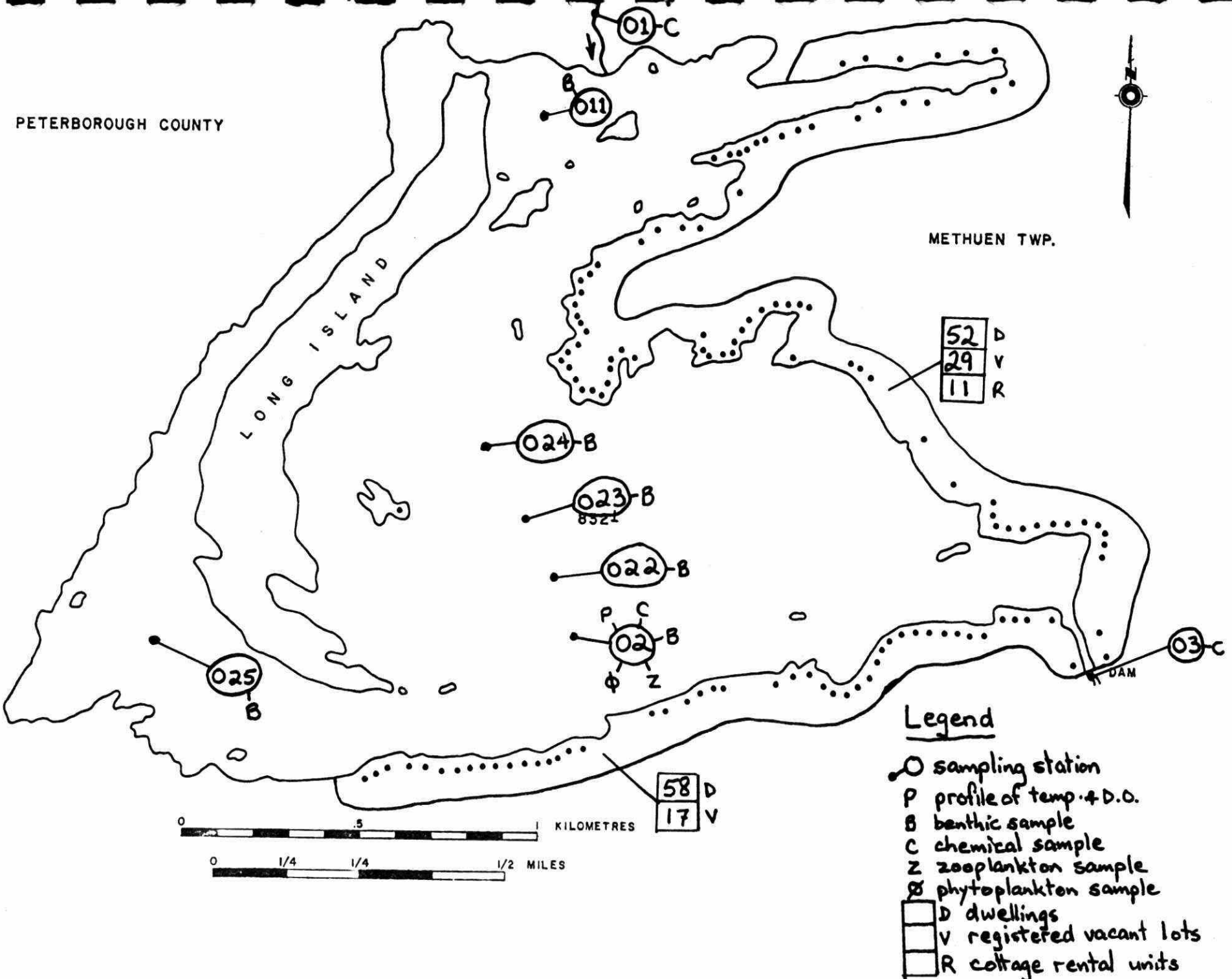
The mean total phosphorus concentration in the water column was moderately high indicating that the lake was moderately enriched or mesotrophic. The composite cell volume determination for Station S1 phytoplankton indicated a significantly lower density than the mean chlorophyll a concentration. This suggested that a significant amount of chlorophyll a present in the water column may have been from resuspended plant material. The most common phytoplankton species in Sandy Lake was Chrysochromulina breviturrita. This species is common in acidic lakes. The dominance of the Chrysophyceae group indicated unenriched water quality conditions.

A relatively high density of crustacean zooplankton was noted at Station S1. The dominant groups were Cyclopoida and Cladocera.

The benthic invertebrate community was almost completely dominated by Chaoborus with variable densities. Both zooplankton and benthos communities may have been influenced more by the shallow nature of the lake than by lake enrichment.

Sandy Lake was characterized by relatively poor water quality which could relate to factors such as apparent colour and the resuspension of organic material from the shallow sediments as well as the enrichment status of the lake. The lake was considered sensitive to further shoreline development because of the small shallow nature of the lake basin.

Oak Lake Sampling Locations and Development 1978



Ontario

Ministry of the Environment

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LAKE Oak

Township Methuen County Peterborough

Joint 7 Links Planning Board - Ministry of the Environment Survey

Morphometry

Surface Area (Ao)	2.671	Km^2
Volume (V)	21.71	$x10^6 m^3$
mean depth (Z)	6.1	m
maximum depth (Zm)	27.0	m
drainage basin (Ad)	8.72	Km^2

Geology of basin (%)

plutonic	25
sedimentary	60
volcanic	
limestone	15

Basin cover (%)

forested	90
cleared	10

Shoreline development

permanent dwellings	4
cottages	113
cottage rental units	13
campground units	0
registered undeveloped	39

Historical Record

Year	Discharge ($x10^6 m^3/yr$)	Tot. P. (ug/l)	Chlor. a (ug/l)	S.D. (m)	Phytopl. ($mm^3 l$)	Zoopl. (No./l)	A.H.O.D. ($mg/m^2/day$)
1970							
1971							
1972							
1973			1.4	4.7			
1974							
1975							
1976							
1977							
1978	3.72	9	2.2	4.9	0.79	23	477 (436)

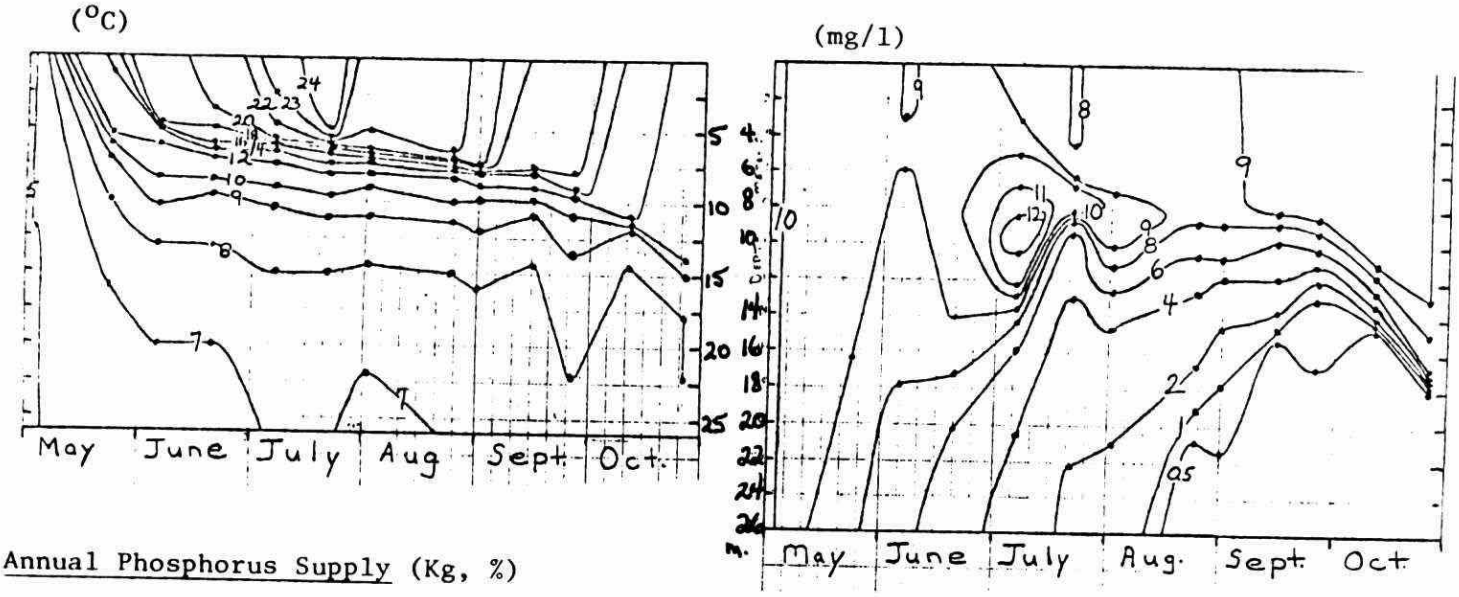
LAKE OAK

Chemistry 1978 (results in mg/l unless otherwise noted) Station 02

	NH_3	TKN	NO_2	NO_3	T. P.	Tot. Org. C	Inorg. C	pH	Cond. (umhos/cm^3)
euphotic max.	0.018	0.44	0.002	0.135	0.012	4.8	13.0	8.05	126
zone min.	0.004	0.31	0.001	0.005	0.007	3.7	12.0	7.19	122
mean	0.007	0.36	0.001	0.033	0.009	4.2	12.4	7.69	123
bottom max.	0.240	0.92	0.011	0.278	0.039	4.0	15.2	7.26	141
waters min.	0.004	0.26	0.001	0.045	0.003	3.7	10.6	6.92	124
mean	0.075	0.040	0.005	0.178	0.013	3.9	12.7	7.03	130

	Ca	Mg	Hard.	Na	K	Alk.	Cl	SO_4	Colour (Hazen U.)	Turbidity (F.T.U.)
euphotic max.	19.0	3.20	60	1.5	0.90	53	1.5	9.0	15	2.70
zone min.	18.0	3.15	58	1.3	0.80	51	1.5	9.0	10	0.90
mean	18.5	3.17	59	1.4	0.85	52	1.5	9.0	12	1.50
bottom max.	20.0	3.20	63	1.5	0.85	61	1.8	9.0	42	3.90
waters min.	18.2	3.15	58	1.2	0.80	52	1.5	7.5	10	0.55
mean	19.0	3.17	60	1.3	0.83	56	1.6	8.2	29	2.10

Temperature/Dissolved Oxygen 1978



Annual Phosphorus Supply (Kg, %)

Land Runoff	48	20.5
Atmosphere	134	57.3
Shoreline Development	52	22.2

LAKE OAK

Phytoplankton 1978
(% of total volume)

Cyanophyceae	52.5
Dinophyceae	0.5
Cryptophyceae	23.7
Chrysophyceae	9.6
Bacillariophyceae	13.0
Chlorophyceae	0.8

Common Species

Aphanizomenon
Cryptomonas
Anabaena
Fragilaria
Rhodomonas

Zooplankton 1978
(% of total numbers)

Calanoida	39.0
Cyclopoida	45.9
Cladocera	11.0
Nauplii	4.1

Common Species

Epischura lacustris
Diaptomus oregonensis
Cyclops scutifer
Mesocyclops edax
Daphnia galeata mendotae
Daphnia pulex
Diaphanosoma
leuchtenbergianum

Benthos 1978
(% of total number) early summer

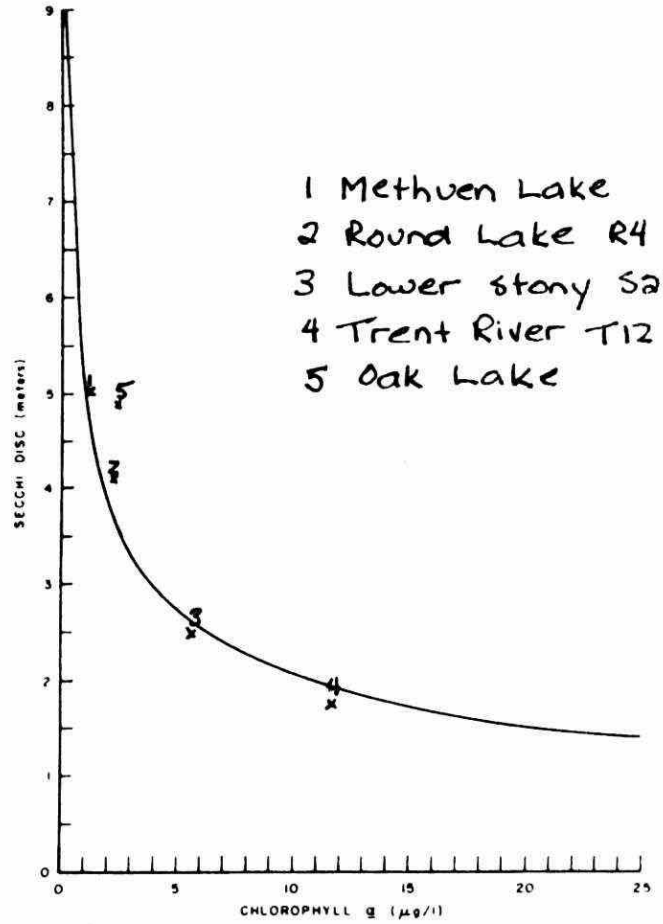
Tubificidae	21.3
Chironomidae	46.7
Chaoboridae	16.2
Other	15.9
Total (Organisms/m^2	258

Common Species

Unid. tubificidae
Chironomus
Procladius
Chaoborus

Aquatic Macrophytes

Chara sp
Potamogeton amplifolius
P. berchtoldii
P. epihydrus
P. gramineus
P. pectinatus
P. praelongus
P. richardsonii
P. robinsii
P. strictifolius
P. zosteriformis
Najas flexilis
Elodea canadensis
Vallisneria americana
Lemna minor
Pontederia cordata
Heteranthera dubia
Ceratophyllum demersum
Brasenia schreberi
Nuphar variegatum
Nymphea odorata
Myriophyllum exalbescens
M. heterophyllum



1 Methven Lake
2 Round Lake R4
3 Lower Stony S27
4 Trent River T12
5 Oak Lake

Ontario

Ministry of the Environment

Central Region

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ROUND LAKE

Round Lake is located about 7 Km northeast of the Village of Havelock in Belmont Township. The lake receives drainage from the North River as well as some minor inflows and discharges via Sebright Bay to the Crowe River system. The lake has 16 permanent residences, 160 cottages, 24 rental units and 25 tent/trailer sites along its shoreline. The lake volume flushed about 4 times during 1978.

Round Lake has hard, alkaline water with a relatively low amount of colour. Water clarity as indicated by Secchi disc was good. Based on this parameter alone, the lake was considered moderately enriched.

The lake did not experience thermal stratification during the sampling period as its shallow depth allowed complete mixing of the water column.

Dissolved oxygen concentration was near saturation through most of the sampling period at all depths.

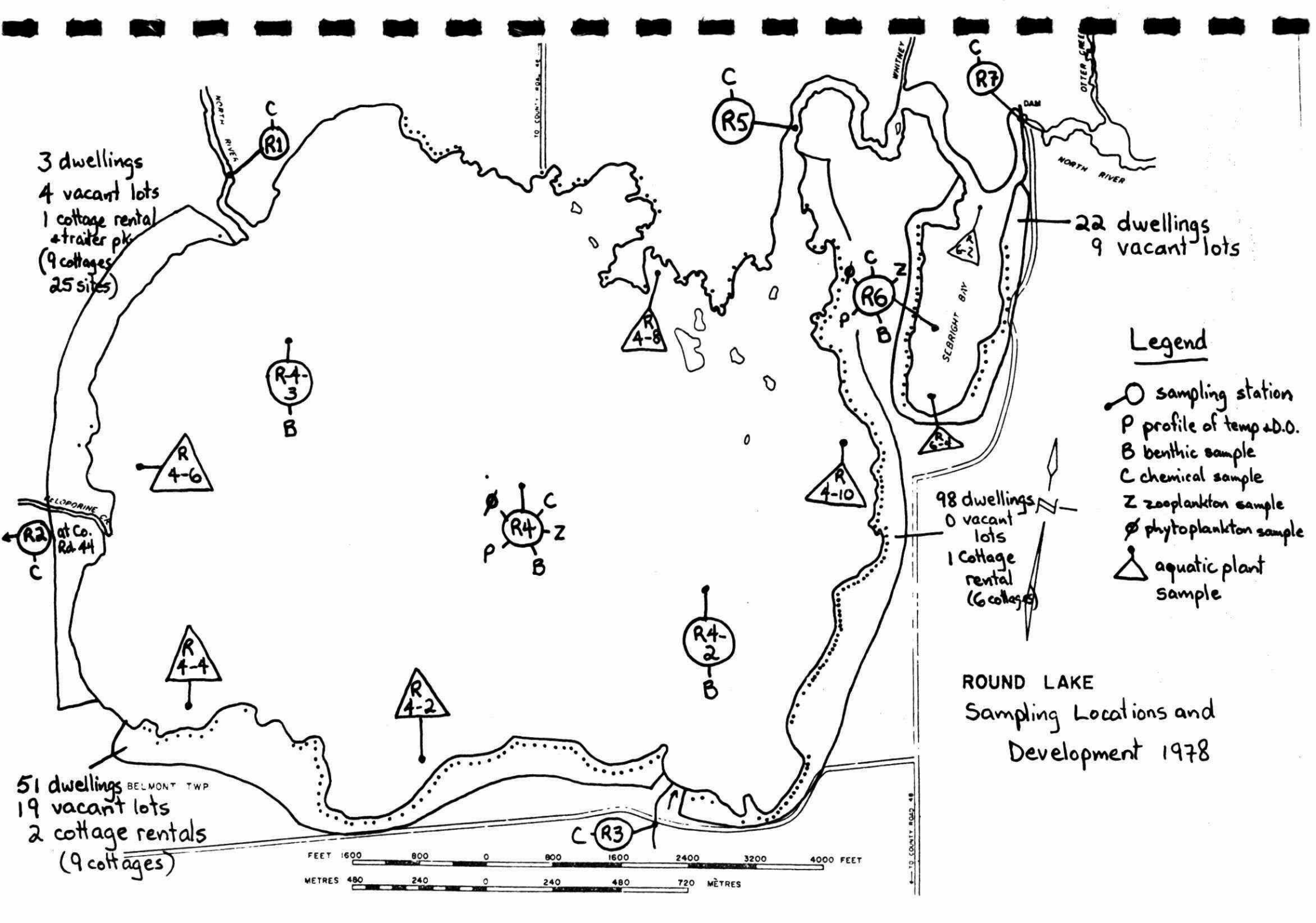
The mean total phosphorus concentration in the euphotic zone of Round Lake was relatively low indicating unenriched or oligotrophic conditions. No accumulation of nutrients was evident in the bottom waters.

Phytoplankton density as indicated by chlorophyll a concentration and composite algae volume determinations was moderate. The common forms in the lake were the same as the forms commonly found in the Bay of Quinte and indicated enriched growth conditions. Anabaena, the most common form can, at higher densities, form scums and create aesthetic problems. Based on density and composition of phytoplankton, Round Lake was considered moderately enriched or mesotrophic. Any significant increase in total phosphorus concentration will enhance growth conditions for bloom forming phytoplankton and may cause undesirable quality effects.

The zooplankton community in the lake was dominated by Cladocera but Calonoida were also well represented. Based on the relatively high density and composition of zooplankton, the lake was considered mesotrophic.

The benthic community was dominated by Chaoborus and all common forms were suited to living in low dissolved oxygen concentrations. Based on density and composition of the benthic community, the lake was considered mesotrophic.

In summary, the water quality status of Round Lake during 1978 was considered mesotrophic. The lake may be sensitive to further unrestricted shoreline development because of the nature of the existing phytoplankton community and the potential for water quality problems in the future. Fortunately the relatively high flushing rate helps to offset this sensitive feature.


3 dwellings
4 vacant lots
1 cottage rental & trailer pk
(9 cottages
25 sites)
NORTH RIVER
TO COUNTY ROAD 45
R1
C
R5
C
WHITNEY
R7
C
DAM
OTTER CREEK
NORTH RIVER
22 dwellings
9 vacant lots
R 4-8
R6
C
Z
P
B
SEBRIGHT BAY
R 6-2
R 6-4
R 4-3
B
R 4-6
R 4-10
98 dwellings
0 vacant lots
1 Cottage rental
(6 cottages)
Legend
sampling station
P profile of temp & D.O.
B benthic sample
C chemical sample
Z zooplankton sample
phytoplankton sample
aquatic plant sample
R4
C
Z
P
B
R2
at Co. Rd 44
C
R 4-4
R 4-2
R 4-2
B
51 dwellings
19 vacant lots
2 cottage rentals
(9 cottages)
BELMONT TWP
C
R3
TO COUNTY ROAD 48
FEET 1600 800 0 800 1600 2400 3200 4000 FEET
METRES 480 240 0 240 480 720 METRES
ROUND LAKE
Sampling Locations and
Development 1978

Ontario

Ministry of the Environment

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LAKE ROUND

Township

County

Joint 7 Links Planning Board - Ministry of the Environment Survey

Morphometry

Surface Area (Ao)	5.68	Km^2
Volume (V)	25.33	$x10^6 m^3$
mean depth (Z)	4.5	m
maximum depth (Zm)	9.8	m
drainage basin (Ad)	257.95	Km^2

Geology of basin (%)

plutonic	45
sedimentary	35
volcanic	
limestone	20

Basin cover (%)

forested	>90
cleared	<10

Shoreline development

permanent dwellings	16
cottages	160
cottage rental units	24
campground units	25
registered undeveloped	30

Historical Record for Station R4

Year	Discharge ($x10^6 m^3/yr$)	Tot. P. (ug/l)	Chlor. a (ug/l)	S.D. (m)	Phytopl. ($mm^3 l$)	Zoopl. (No./l)	A.H.O.D. ($mg/m^2/day$)
1970							
1971							
1972							
1973							
1974							
1975							
1976							
1977				2.9			
1978	101.95	10	2.6	4.0	0.8	27	
1978 (Sta. R6)		10	3.6	4.1			

LAKE ROUND

Chemistry 1978 (results in mg/l unless otherwise noted) Station R4

	NH_3	TKN	NO_2	NO_3	T. P.	Tot. Org. C	Inorg. C	pH	Cond. (umhos/cm^3)
euphotic max.	0.022	0.41	0.003	0.135	0.014	5.3	24.0	8.20	215
zone min.	0.004	0.30	0.001	0.005	0.005	4.5	23.6	7.66	200
mean	0.011	0.34	0.002	0.028	0.010	5.0	23.8	7.99	210
bottom max.	0.024	0.38	0.004	0.100	0.016			8.22	215
waters min.	0.008	0.31	0.001	0.005	0.007			7.87	205
mean	0.016	0.35	0.002	0.030	0.011	5.0	23.4	8.05	211

	Ca	Mg	Hard.	Na	K	Alk.	Cl	SO_4	Colour (Hazen U.)	Turbidity (F.T.U.)
euphotic max.	38	3.5	108	1.8	0.80	100	2.3	12.0	18	1.40
zone min.	35	3.1	102	1.7	0.75	97	2.1	9.5	11	0.65
mean	37	3.3	105	1.7	0.78	98	2.2	10.5	15	0.95
bottom max.										
waters min.										
mean	38	3.45	109	1.8	0.85	99	2.1	10.0	21	0.75

Temperature/Dissolved Oxygen 1978

(^oC) (mg/l)

no stratification

D. O. at or near saturation through ice free period

Annual Phosphorus Supply (Kg, %)

Land Runoff	1281	76
Atmosphere	284	17
Shoreline Development	85	5

LAKE ROUND (Sebright Bay)

Chemistry 1978 (results in mg/l unless otherwise noted) Station R6

		NH_3	TKN	NO_2	NO_3	T. P.	Tot. Org. C	Inorg. C	pH	Cond. (umhos/cm^3)
euphotic zone	max.	0.034	0.43	0.005	0.120	0.013	5.9	23.4	7.89	215
	min.	0.006	0.27	0.001	0.005	0.007	4.4	17.6	7.59	170
	mean	0.014	0.36	0.002	0.022	0.010	5.4	20.8	7.79	195
bottom waters	max.									
	min.									
	mean									

		Ca	Mg	Hard.	Na	K	Alk.	Cl	SO_4	Colour (Hazen U.)	Turbidity (F.T.U.)
euphotic zone	max.	32	3.55	100	1.8	0.85	93	2.1	9.5	25	1.2
	min.	28	2.85	82	1.7	0.70	75	1.9	9.5	14	0.8
	mean	34	3.27	93	1.8	0.77	86	2.0	9.5	20	1.1
bottom waters	max.										
	min.										
	mean										

Temperature/Dissolved Oxygen 1978

(^oC) (mg/l)

Annual Phosphorus Supply (Kg, %)

Land Runoff	____	____
Atmosphere	____	____
Shoreline Development	____	____

LAKE ROUND

Phytoplankton 1978
(% of total volume)

Cyanophyceae	38.3
Dinophyceae	0.9
Cryptophyceae	2.4
Chrysophyceae	8.1
Bacillariophyceae	46.9
Chlorophyceae	3.4

Common Species

Anabaena
Melosira
Stephanodiscus

Zooplankton 1978
(% of total numbers)

Calanoida	24.4
Cyclopoida	24.9
Cladocera	46.7
Nauplii	4.1

Common Species

Bosmina sp.
Chydorid unid.
Cyclops scutifer
Daphnia retrocurva
Diaphanosoma leuchtenbergianum
Diaptomus oregonesis
Epischura lacustris
Mesocyclops edax

Benthos 1978
(% of total number)

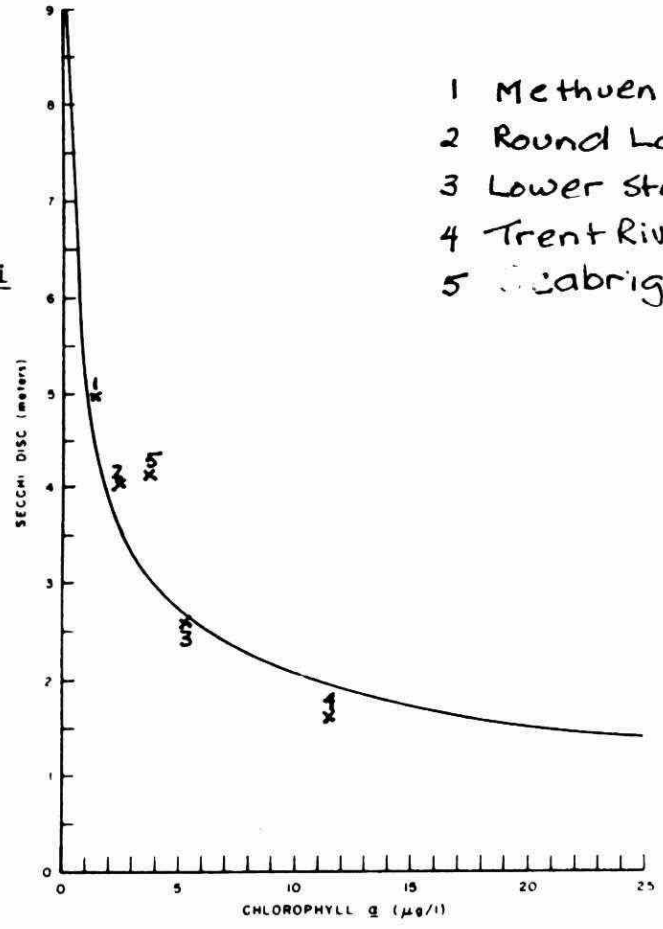
Tubificidae	1.1	2.5
Chironomidae	66.7	8.9
Chaoboridae	11.8	87.9
Other	20.4	0.6
Total (Organisms/m^2	1511	3003

Common Species

Chironomus
Chaoborus
Procladius
Tanytarsini
unid. Tubificidae

Aquatic Macrophytes

Chara sp.
Nitella sp.
Sparganium sp
Potamogeton amplifolius
P. epihydrus
P. friesii
P. illinoensis
P. natans
P. pectinatus
P. perfoliatus
P. praelongus
P. pusillus
P. richardsonii
P. robbinsii
P. strictifolius
P. zosteriformis
Najas flexilis
Sagittaria sp
Elodea canadensis
Vallisneria americana
Pontederia cordata
Heteranthera dubia
Juncus militaris
Ceratophyllum demersum
Nuphar variegatum
Nymphea odorata
Ranunculus sp
Myriophyllum exalbescens
M. heterophyllum
Utricularia vulgaris
Megalodonta beckii



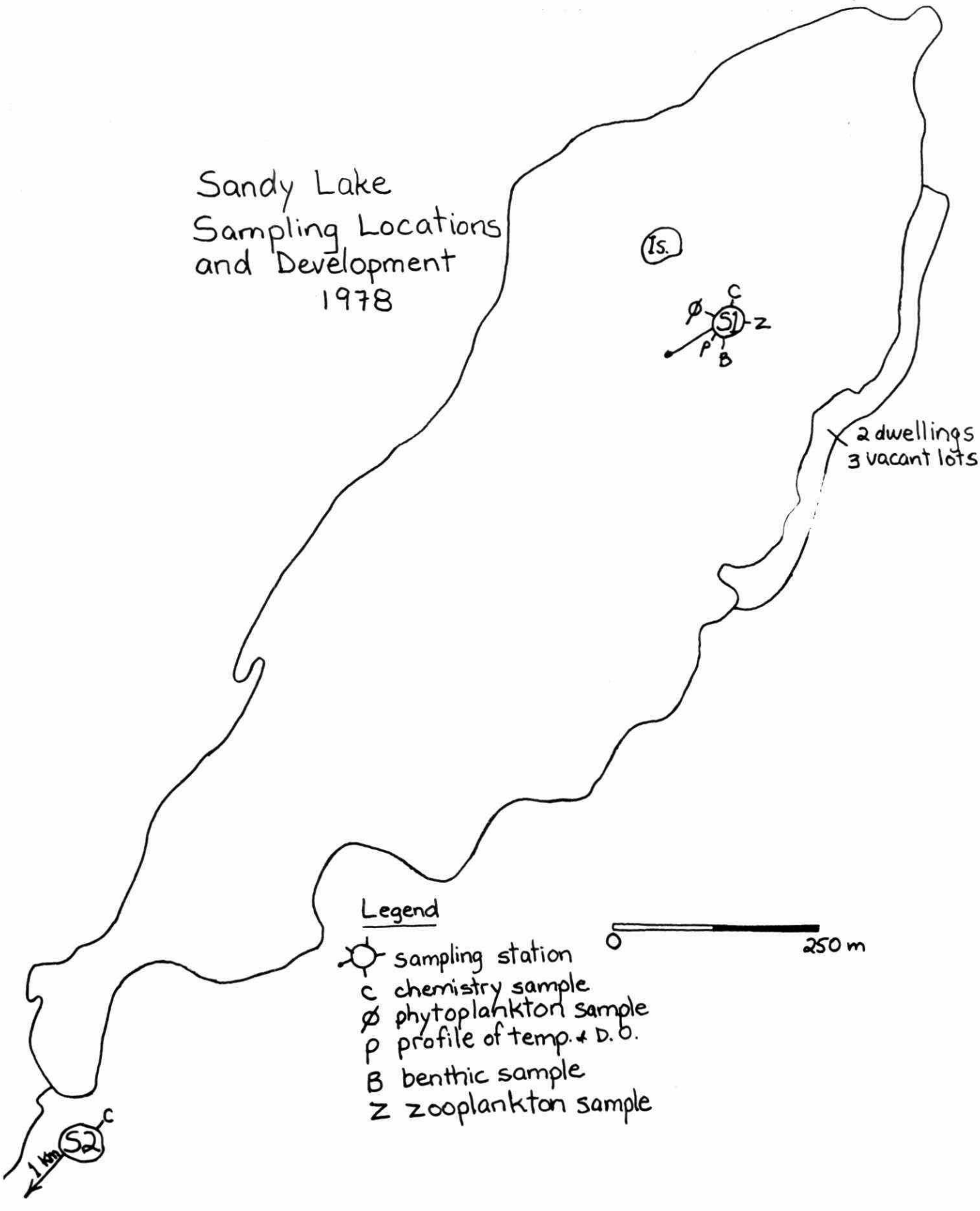
1 Methuen Lake
2 Round Lake R4
3 Lower Stony S27
4 Trent River T12
5 Scabright Bay

Phytoplankton densities in the euphotic zone of Oak Lake were favorably low. However, the dominant phytoplankton group was the Cyanophyceae (blue-green algae). The most common species found in the euphotic zone was Aphanizomenon. This algae requires at least moderately enriched conditions to thrive and in enriched conditions it commonly "blooms" or forms unsightly scums and streaks in the water column. If the phosphorus concentration in the lake were increased significantly, Aphanizomenon and Anabaena (another common form in the lake) could create undesirable water quality conditions. Base on phytoplankton density and composition, the lake was considered moderately enriched.

The zooplankton community in the lake was dominated by Calanoida and Cyclopoida. Calanoida are often the dominant group in unenriched lakes. The density was moderate and when considered with composition, suggested that the lake was moderately enriched or mesotrophic.

The density of benthic invertebrates in the deep lake sediments was low with the Chironomidae and Tubificidae dominating. Although the density of organisms suggested oligotrophic conditions, the dominant organisms indicated that some enrichment was occurring. Based on benthos density and composition, the Lake was considered moderately enriched or mesotrophic.

In summary, the water quality status of Oak Lake during 1978 was good. The lake was considered mesotrophic or moderately enriched but bordered on oligotrophic conditions. Several features about the lake indicated that it was sensitive to further unrestricted shoreline development.


Sandy Lake
Sampling Locations
and Development
1978
Is.
S1
C
Ø
Z
P
B
2 dwellings
3 vacant lots
Legend
sampling station
c chemistry sample
Ø phytoplankton sample
p profile of temp. & D.O.
B benthic sample
Z zooplankton sample
0
250 m
1 km
S2
C

Ontario

Ministry of the Environment

Central Region

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LAKE SANDY

Township Methuen County Peterborough

Joint 7 Links Planning Board - Ministry of the Environment Survey

Morphometry

Surface Area (Ao)	0.518	Km^2
Volume (V)	0.748	$x10^6 m^3$
mean depth (Z)	1.4	m
maximum depth (Zm)	4.5	m
drainage basin (Ad)	6.83	Km^2

Geology of basin (%)

plutonic	
sedimentary	100
volcanic	
limestone	

Basin cover (%)

forested	100
cleared	

Shoreline development

permanent dwellings	0
cottages	2
cottage rental units	0
campground units	0
registered undeveloped	3

Historical Record

Year	Discharge ($x10^6 m^3/yr$)	Tot. P. (ug/l)	Chlor. a (ug/l)	S.D. (m)	Phytopl. ($mm^3 l$)	Zoopl. (No./l)	A.H.O.D. ($mg/m^2/day$)
1970							
1971							
1972							
1973							
1974							
1975							
1976							
1977							
1978	2.75	13	5.9	1.8	0.87	49	

LAKE SANDY

Chemistry 1978 (results in mg/l unless otherwise noted) Station S1

		NH_3	TKN	NO_2	NO_3	T. P.	Tot. C	Org. C	Inorg. C	pH	Cond. (umhos/cm^3)
euphotic zone	max.	0.116	0.60	0.003	0.070	0.016	10.0		1.0	6.71	30
	min.	0.004	0.18	0.002	0.005	0.004	8.2		0.8	6.28	28
	mean	0.023	0.49	0.002	0.016	0.013	8.9		0.9	6.46	29
bottom waters	max.										
	min.										
	mean										

euphotic zone usually reached bottom waters

		Ca	Mg	Hard.	Na	K	Alk.	Cl	SO_4	Colour (Hazen U.)	Turbidity (F.T.U.)
euphotic zone	max.	3.0	0.65	10	0.8	0.75	7	0.8	6.5	56	1.4
	min.	2.8	0.60	10	0.8	0.65	6	0.6	5.5	55	1.1
	mean	2.9	0.63	10	0.8	0.68	6	0.7	6.0	56	1.2
bottom waters	max.										
	min.										
	mean										

euphotic zone usually reached bottom waters

Temperature/Dissolved Oxygen 1978

(^oC) (mg/1)

non-stratified

at or near saturation through the sampling period

Annual Phosphorus Supply (Kg, %)

Land Runoff	38	59
Atmosphere	26	40
Shoreline Development	0.8	1

LAKE SANDY

Phytoplankton 1978
(% of total volume)

Cyanophyceae	1.8
Dinophyceae	13.4
Cryptophyceae	21.4
Chrysophyceae	41.7
Bacillariophyceae	11.6
Chlorophyceae	9.1

Common Species

Chrysochromulina breviturrita
Chrysosphaerella
Cryptomonas
Cyclotella
Rhizosolenia
Arthrodesmus
Peridinium wisconsinense

Zooplankton 1978
(% of total numbers)

Calanoida	10.9
Cyclopoida	44.2
Cladocera	41.1
Nauplii	3.8

Common Species

Bosmina sp
Diaphanosoma leuchtenbergianum
Daphnia retrocurva
Cyclops scutifer
Diaptomus oregonensis

Benthos 1978
(% of total number)

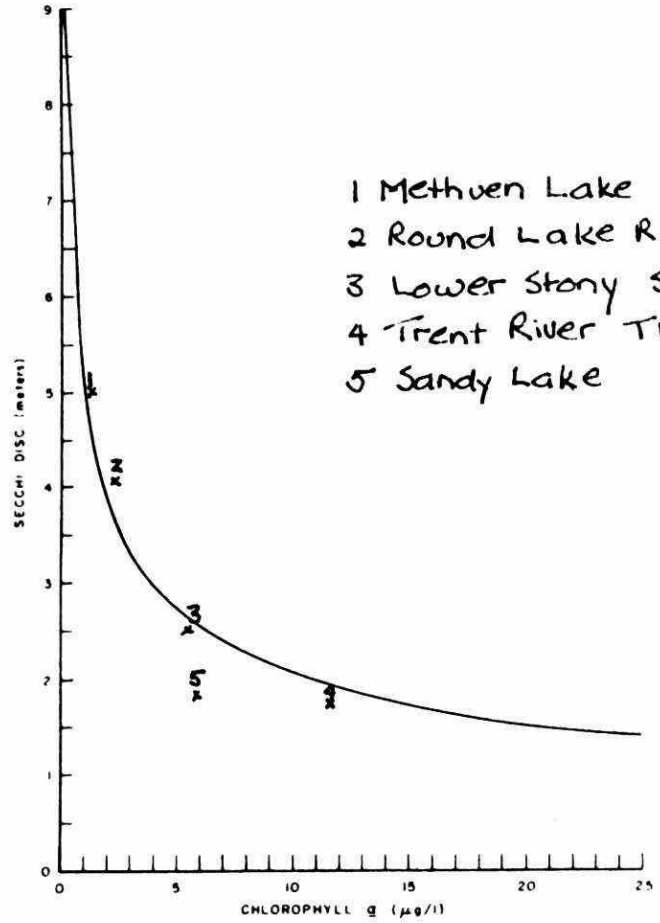
Tubificidae	0	0
Chironomidae	0	0.5
Chaoboridae	91.7	99.5
Other	8.3	0
Total (Organisms/m^2	229	7629

Common Species

Chaoborus
Kiefferulus
Cryptochironomus

Aquatic Macrophytes

Nitella sp
Sparganium sp
P. epihydrus
P. pectinatus
Najas flexilis
Sagittaria sp.
Eriocaulon septangulare
Pontederia cordata
Brasenia schreberi
Nuphar variegatum
Nymphea odorata
Utricularia cornuta
U. intermedia
U. vulgaris



1 Methven Lake
2 Round Lake R4
3 Lower Stony S27
4 Trent River T12
5 Sandy Lake

Ontario

Ministry of the Environment

Central Region

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SOUTH LAKE

South Lake is situated about 16 kilometers north of the Village of Havelock in Methuen Township. The lake receives flow from the North River and aN unnamed creek flowing from Oak Lake. There were one permanent and seven cottages on the lake shore line during 1978. The lake flushing rate was moderately high (5.6 a year to the -1).

South Lake had moderately hard, slightly alkaline water with a moderate amount of colour. Water clarity as indicated by Secchi disc was moderate with a mean value of 3.1 metres. Clarity may have been somewhat depressed because of the colour in the water column.

Thermal stratification was noted at Station S6 through late spring and summer. The lake was completely mixed and uniform in temperature from surface to bottom by October 1978.

The dissolved oxygen distribution showed a clinograde profile (gradually decreasing in the bottom waters with depth). The minimum dissolved oxygen concentration noted in the bottom waters was less than 1 mg/l. The decrease in dissolved oxygen was probably due to the decomposition of accumulating organic matter and the sediment oxygen demand.

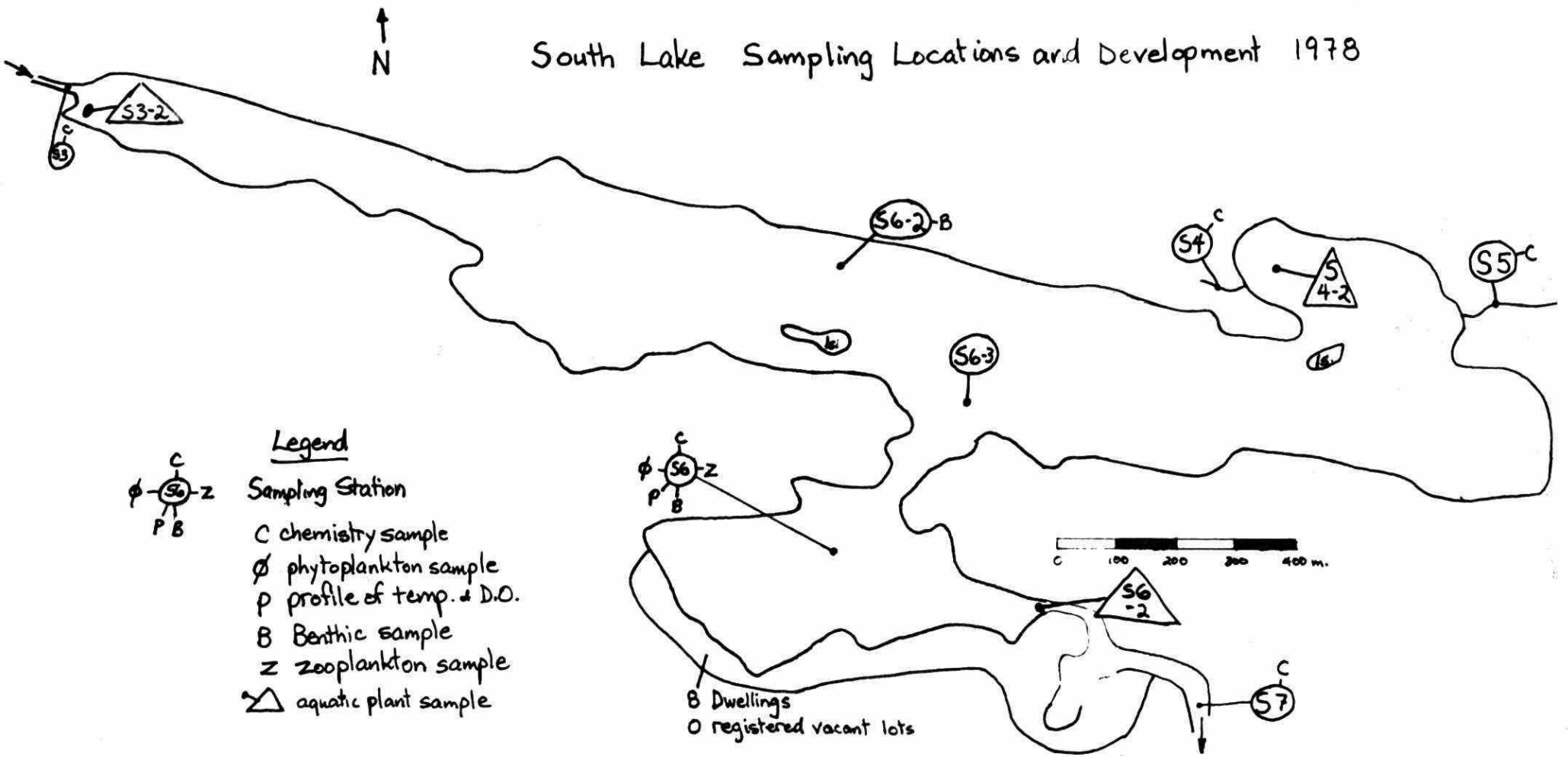
Total phosphorus concentration in the euphotic zone was moderately high indicating that the lake was moderately enriched or mesotrophic.

Phytoplankton density was moderately high. The community of phytoplankton was dominated by the Chrysophyceae. This group generally indicates unenriched water quality conditions. Based on phytoplankton density and community structure, South Lake was considered moderately enriched or mesotrophic.

The crustacean zooplankton community was dominated by Cladocera and Cyclopoida. These groups typically dominate moderately enriched and enriched waters. Based on zooplankton density and composition, the lake was considered moderately enriched or mesotrophic.

The benthic invertebrate community was dominated by Chaoborus. This organism is well suited to living in low dissolved oxygen conditions. Densities suggested moderate to heavy enrichment.

South Lake was characterised by moderately good water quality and was considered mesotrophic. The lake was considered moderately sensitive to further shoreline development.


N
South Lake Sampling Locations and Development 1978
S3-2
S3
C
S6-2-B
S4
C
S4-2
S5
C
S6-3
S6
C
Φ
Z
P
B
S6-2
S7
C
Legend
Sampling Station
C chemistry sample
Φ phytoplankton sample
P profile of temp. & D.O.
B Benthic sample
Z zooplankton sample
aquatic plant sample
B Dwellings
O registered vacant lots
0 100 200 300 400 m.

Ontario

Ministry of the Environment

Central Region

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LAKE South

Township County

Joint 7 Links Planning Board - Ministry of the Environment Survey

Morphometry

Surface Area (Ao)	0.471	Km^2
Volume (V)	1.58	$x10^6 m^3$
mean depth (Z)	3.3	m
maximum depth (Zm)	8.5	m
drainage basin (Ad)	21.95	Km^2

Geology of basin (%)

plutonic	60
sedimentary	33
volcanic	0
limestone	7

Basin cover (%)

forested	90
cleared	10

Shoreline development

permanent dwellings	1
cottages	7
cottage rental units	0
campground units	0
registered undeveloped	0

Historical Record

Year	Discharge ($x10^6 m^3$/yr)	Tot. P. (ug/l)	Chlor. a (ug/l)	S.D. (m)	Phytopl. (mm^3l)	Zoopl. (No./l)	A.H.O.D. (mg/m^2/day)
1970							
1971							
1972							
1973							
1974							
1975							
1976							
1977							
1978	8.85	14	4.3	3.1	1.95	25	

LAKE South

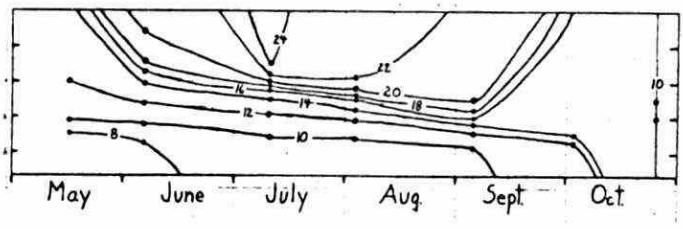
Chemistry 1978 (results in mg/l unless otherwise noted)

	NH_3	TKN	NO_2	NO_3	T. P.	Tot. Org. C	Inorg. C	pH	Cond. (umhos/cm^3)
euphotic max.	0.030	0.43	0.014	0.020	0.024	6.0	11.4	7.34	112
zone min.	0.002	0.34	0.001	0.005	0.010	4.7	8.6	7.05	89
mean	0.012	0.38	0.003	0.008	0.014	5.4	10.1	7.22	102
bottom max.	0.198	0.49	0.004	0.095	0.025			7.42	110
waters min.	0.006	0.38	0.001	0.005	0.011			6.68	90
mean	0.050	0.41	0.002	0.035	0.016	5.3	8.5	7.00	98

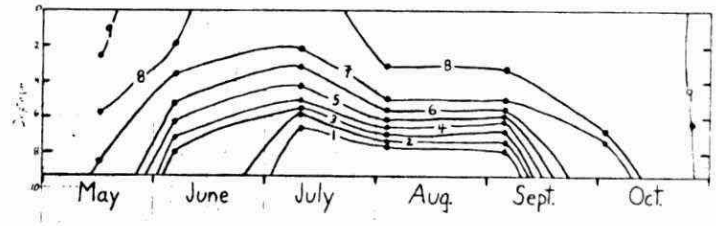
	Ca	Mg	Hard.	Na	K	Alk.	Cl	SO_4	Colour (Hazen U.)	Turbidity (F.T.U.)
euphotic max.	17.0	2.70	54	1.9	0.90	47	1.9	8.5	32	1.9
zone min.	12.4	1.70	38	1.5	0.85	36	1.7	5.5	25	0.8
mean	14.9	2.23	47	1.7	0.88	43	1.8	6.8	29	1.3
bottom max.										
waters min.										
mean	12.7	1.75	40	1.8	0.92	36	1.7	7.8	33	1.4

Temperature/Dissolved Oxygen 1978

(^oC)



(mg/l)



Annual Phosphorus Supply (Kg, %)

Land Runoff	127	82
Atmosphere	24	16
Shoreline Development	3.5	2

LAKE South

Phytoplankton 1978
(% of total volume)

Cyanophyceae	5.6
Dinophyceae	6.1
Cryptophyceae	18.2
Chrysophyceae	45.1
Bacillariophyceae	20.3
Chlorophyceae	4.6

Common Species

Cryptomonas
Synura
Chrysosphaerella
Stephanodiscus
Dinobryon
Tabellaria
Synedra
Rhizosolenia
Chlamydomonas

Aquatic Macrophytes

Chara sp.
Nitella sp.
Potamogeton illinoensis
P. natans
P. praelongus
P. pusillus
P. robbinsii
P. zosteriformis
Najas flexilis
Sagittaria sp.
Elodea canadensis
Pontederia cordata
Heteranthera dubia
Ceratophyllum demersum
Brasenia schreberi
Nymphea Odorata
Myriophyllum exalbescens
M. heterophyllum
Utricularia vulgaris
Megalodonta beckii

Zooplankton 1978
(% of total numbers)

Calanoida	5.4
Cyclopoida	45.0
Cladocera	47.2
Nauplii	2.4

Common Species

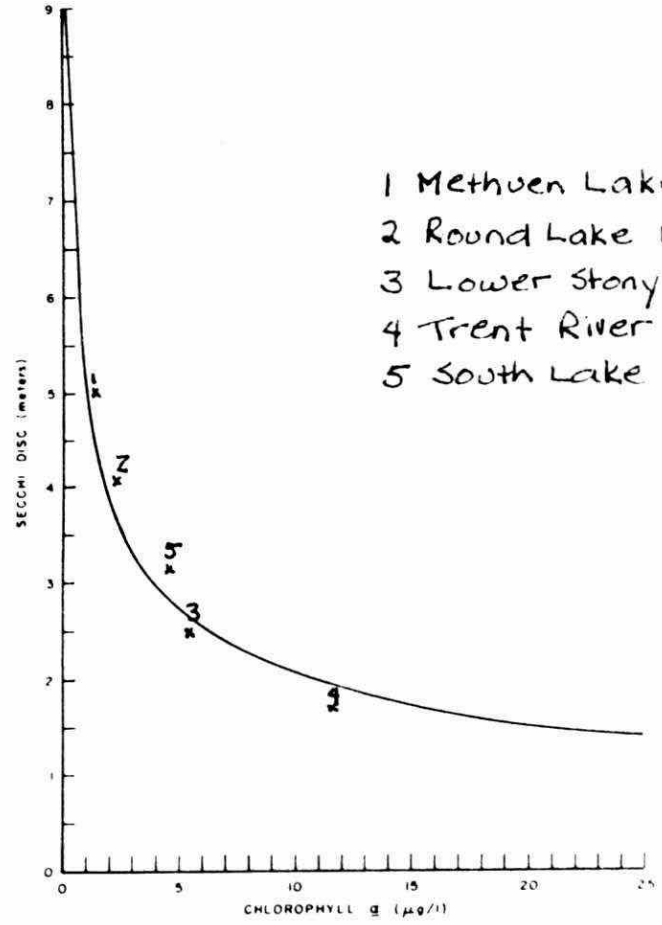
Diaphanosoma leuchtenbergianum
Daphnia retrocurva
Holopedium gibberum
Bosmina sp.
Mesocyclops edax
Cyclops scutifer
Diaptomus oregonensis

Benthos 1978

(% of total number)	early summer	late summer
Tubificidae	0.7	0
Chironomidae	1.8	0
Chaoboridae	94.9	99.8
Other	2.5	0.2
Total (Organisms/m^2)	1103	8.52

Common Species

Chaoborus
Ceratopogonidae larvae
Chironomus



1 Methven Lake
2 Round Lake R4
3 Lower Stony S27
4 Trent River T12
5 South Lake

Ontario

Ministry of the Environment

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STONY LAKE

Stony Lake is located about 32 km northeast of the City of Peterborough on the border between Dummer and Burleigh Townships. The lake receives drainage from a large area including most of the Kawartha Lakes. Drainage from Stony Lake flows southward to Clear Lake which flows into Katchewanooka Lake which in turn flows into the Otonabee River. Stony Lake can be divided into two parts based on the lake basin shape and flow pattern. The "upper" or eastern basin is tributary to the main flow through from the Trent Canal System. The "lower" or western basin receives flow from the main Trent Canal System and from the "eastern" basin of the lake. Unfortunately it was not possible to separate the morphometric information between the two basins in the time frame of this study. For the purposes of this report water quality aspects of the two basins will be dealt with individually.

Upper Basin

The upper basin of the lake had approximately 664 cottages, 81 rental units and 122 camp ground units during 1978.

The upper basin of Stony Lake had moderately hard, alkaline water with a moderately low amount of colour. Thermal stratification was noted at both lake stations (S60 and S105). Water clarity as indicated by Secchi disc was good indicating relatively unenriched conditions.

The dissolved oxygen distribution at the lake stations was generally clinograde (gradually decreasing with depth) but also showed a slight minimum within the thermocline and bottom waters during July. This minimum may have resulted from the oxygen demand of zooplankton inhabiting that layer of the water column. Dissolved oxygen concentration in the bottom waters reached a minimum of less than 0.5 mg/l by October, 1978. The aerial hypolimnetic oxygen demand for the basin represented by Station S105 was calculated to be about 496 mg/m^3 day. This value falls within the mesotrophic limits suggested by Mortimer (1941, 1942).

Mean total phosphorus concentration in the surface waters of the upper basin was 8 mg/l at Station S105 and 10 mg/l at Station S60. Based on total phosphorus concentration the upper basin of Stony Lake was considered unenriched or oligotrophic. There was no significant accumulation of nutrients in the bottom waters at either station.

Phytoplankton denisty as indicated by chlorophyll a and composite algal volume determinations was moderately low. The phytoplankton was dominated by the Chyrsophyceae with Chrysosphaerella and Dinobryon appearing as the most common forms. Although the composition of phytoplankton indicated less enriched conditions than the lower basin, the bloom forming blue-green algae or Cyanophyceae were still well represented. If a significant increase in the phosphorus input to the upper basin were to occur these forms would become more common in the basin and perhaps cause undesirable water quality problems.

Crustacean zooplankton densities were relatively low. The dominant forms were the Calanoida. The most common species in the basin was Limnocalanus macrurus which thrives in the cool but well oxygeniated waters just below the thermocline. Based on the density and composition of the zooplankten the upper basin was considered unenriched or oligotrophic.

Chironomidae dominated the benthic invertebrate community during early and late summer in the upper basin. Moreover tubificidae became more common in late summer. These two groups were well suited to living in low oxygen conditions. Ponteporeia affinis a fresh water scud was also found in the basin. This organism is sensitive to low dissolved oxygen conditions and its presence indicated relatively good water quality conditions. The density and composition of the benthic community indicated that the upper basin of Stony Lake was moderately enriched or mesotrophic.

Considering the historical information for Station S105, it appears that the water quality status of the upper basin has not changed significantly over the past 8 years.

Lower Basin

The basin has hard, alkaline water. Thermal stratification was observed at Stations S27 and S38. The dissolved oxygen distribution at the lake stations was clinograde with minimum bottom water concentration reaching 0.0 mg/l at Station S27 from late July to September. These conditions probably reflect the decomposition of a greater amount of organic matter that accumulated in the bottom waters.

Mean total phosphourus concentration in the euphotic zone at Stations S27, S38 and C28 indicated moderately enriched or mesotrophic conditions. Minor accumulation of nutrients was noted only at Station S27.

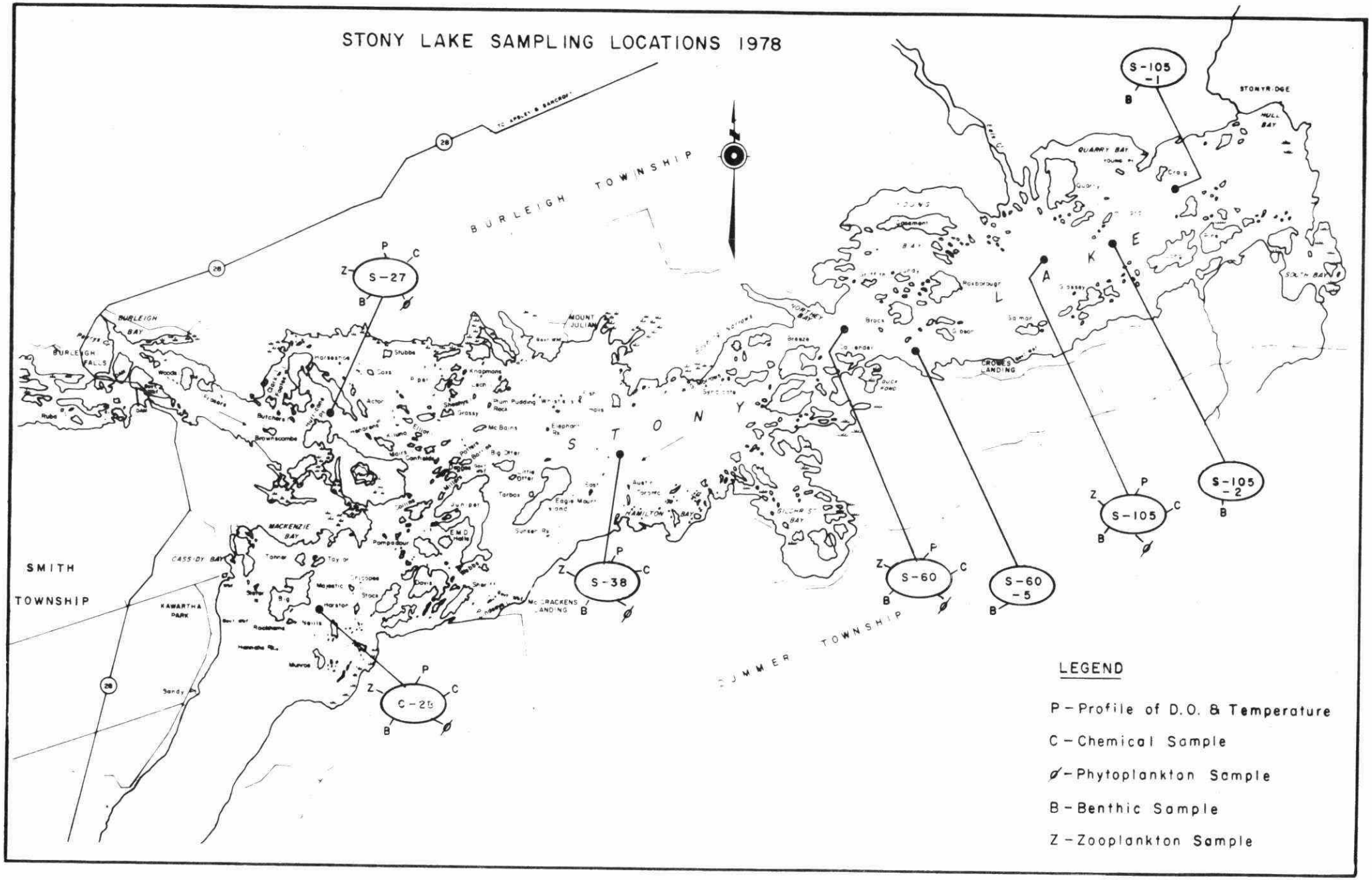
Phytoplankton density was relatively high indicating enriched or eutrophic conditions. The common forms of phytoplankton were the same as those most common to the Bay of Quinte (KLWMS) and were dominated by Bacillariophyceae and Cyanophyceae. Surface scum and streaking of the water column by algal blooms were observed in late summer through the lower basin. Based on phytoplankton density and composition the lower basin was considred euphtrophic.

The crustation zooplankton community by contrast to upper basin was dominated by cladocera with higher total densities. Based on these findings alone, the lower basin was considered mesotrophic.

The benthic community in the lower basin was dominated by tubificidae with moderately low total densities. The community composition indicated much more euptrophic conditions than were found in the upper basin.

In view of the historical information for Station S27, the water quality of the lower basin does not appear to have changed significantly since 1972. There may be an increasing trend in total phosphorus concentration, but this can only be verified by further sampling in future years.

In summary, there was a significant difference in the water quality status of the upper basin of Stony Lake as compared with the lower basin. The lower basin was mesotrophic bordering on eutrophic conditions while the upper basin bordered oligotrophic conditions. In view of the large inputs of phosphorus to the overall lake complex (Clear and Stony) from natural sources, lower Stony Lake may not be particularly sensitive to further unrestricted shoreline development. The upper basin of Stony Lake, having much less natural drainage and better water quality conditions at present, may be more sensitive to further development.


STONY LAKE SAMPLING LOCATIONS 1978
BURLEIGH TOWNSHIP
SMITH TOWNSHIP
DUMMER TOWNSHIP
S T O N Y
L A K E
S-27
S-38
C-25
S-60
S-60 -5
S-105 -1
S-105
S-105 -2
BURLEIGH BAY
BURLEIGH FALLS
MOUNT JULIAN
MACKENZIE BAY
CASSIDY BAY
KAWARTHA PARK
McCRACKENS LANDING
CROWES LANDING
QUARRY BAY
STONYRIDGE
HULL BAY
SOUTH BAY
LEGEND
P - Profile of D.O. & Temperature
C - Chemical Sample
ø - Phytoplankton Sample
B - Benthic Sample
Z - Zooplankton Sample

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LAKE STONY (Lower Basin)

Township Dummer, Burleigh County Peterborough

Joint 7 Links Planning Board - Ministry of the Environment Survey

Morphometry for Stony & Clear to Young's Point

Surface Area (Ao)	28.24	Km^2
Volume (V)	165.815	$x10^6m^3$
mean depth (Z)	5.9	m
maximum depth (Zm)	33	m
drainage basin (Ad)	7265	Km^2

Geology of basin (%)

plutonic	
sedimentary	
volcanic	
limestone	

Basin cover (%)

forested	
cleared	

Shoreline development Dummer Tp

permanent dwellings	0
cottages	371
cottage rental units	72
campground units	0
registered undeveloped	0

Historical Record for Station S27

Year	Discharge ($x10^6m^3/yr$)	Tot. P. (ug/l)	Chlor. a (ug/l)	S.D. (m)	Phytopl. (mm^3l)	Zoopl. (No./l)	A.H.O.D. ($mg/m^2/day$)
1970							
1971							
1972		14	4.7	2.5	2.7		
1973							
1974							
1975							
1976		10	5.7	2.3	1.9*		
1977							
1978 (S27)		18	5.7	2.6	2.44	17	
1978 (S38)		15	5.4	3.2	4.89	25	
1978 (C28)		15	5.6	2.9	2.05	34	

* average of 1 monthly sample May to September 1976.

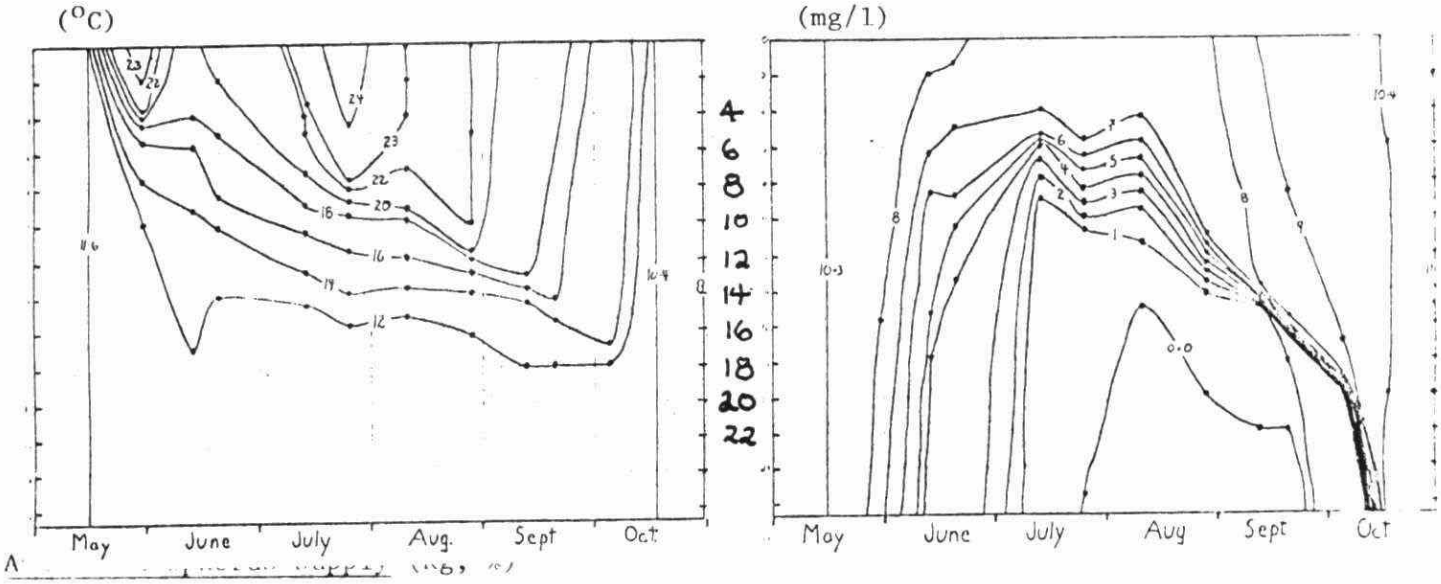
LAKE STONY (Lower Basin)

Chemistry 1978 (results in mg/l unless otherwise noted) Station S27

	NH_3	TKN	NO_2	NO_3	T. P.	Tot. Org. C	Inorg. C	pH	Cond. (umhos/cm^3)
euphotic max.	0.028	0.52	0.004	0.195	0.025	6.0	20.4	8.00	210
zone min.	0.010	0.38	0.002	0.005	0.012	4.8	19.0	7.03	185
mean	0.018	0.45	0.003	0.044	0.018	5.6	19.7	7.75	201
bottom max.	0.770	1.50	0.009	0.190	0.092	5.8	24.8	8.02	200
waters min.	0.008	0.41	0.002	0.005	0.012	4.8	19.0	7.06	185
mean	0.368	0.82	0.004	0.065	0.036	5.5	21.1	7.40	194

	Ca	Mg	Hard.	Na	K	Alk.	Cl	SO_4	Colour (Hazen U.)	Turbidity (F.T.U.)
euphotic max.	35	3.45	99	3.0	0.95	87	5.0	14.0	20	1.7
zone min.	31	2.90	91	2.8	0.80	81	4.7	12.0	14	1.0
mean	33	3.18	95	2.9	0.88	84	4.8	13.2	16	1.4
bottom max.	35	3.15	99	3.0	1.05	90	4.8	14.0	108	2.2
waters min.	28	2.70	83	2.2	0.90	81	3.8	9.5	15	1.0
mean	32	2.90	91	2.7	0.97	85	4.4	12.3	47	1.5

Temperature/Dissolved Oxygen 1978 Station S27



Land Runoff	33,000	71
Atmosphere	4,700	10
Shoreline Development	8,800	19

taken from Table 8 Page 133 of The Kawartha Lakes Water Quality Management Study - Water Quality Assessment (1972-1976) Nov. 1976 MOE - MNR report. (KLWMS)

LAKE STONY (Lower Basin)

Chemistry 1978 (results in mg/l unless otherwise noted) Station S38

	NH_3	TKN	NO_2	NO_3	T. P.	Tot. Org. C	Inorg. C	pH	Cond. (umhos/cm^3)
euphotic max.	0.028	0.64	0.003	0.180	0.021	4.8	20.0	8.12	200
zone min.	0.006	0.34	0.001	0.005	0.006	5.8	16.8	7.82	180
mean	0.012	0.43	0.002	0.030	0.015	5.3	18.7	7.98	191
bottom max.	0.066	0.58	0.003	0.185	0.022	5.9	20.0	8.12	200
waters min.	0.006	0.35	0.001	0.005	0.008	5.2	16.8	7.35	180
mean	0.030	0.45	0.002	0.042	0.014	5.5	18.6	7.71	190

	Ca	Mg	Hard.	Na	K	Alk.	Cl	SO_4	Colour (Hazen U.)	Turbidity (F.T.U.)
euphotic max.	32	3.0	92	2.8	0.95	85	4.6	13.0	17	1.4
zone min.	29	2.6	85	2.5	0.80	75	3.8	12.0	15	1.0
mean	30	2.9	88	2.7	0.87	80	4.3	12.5	16	1.2
bottom max.	31	3.0	88	2.9	0.90	86	4.6	13.0	23	1.5
waters min.	30	2.6	85	2.4	0.80	75	3.9	12.0	14	0.9
mean	29	2.9	87	2.7	0.85	80	4.4	12.5	17	1.1

Temperature/Dissolved Oxygen 1978

(^oC) (mg/l)

Annual Phosphorus Supply (Kg, %)

Land Runoff	_____	_____
Atmosphere	_____	_____
Shoreline Development	_____	_____

LAKE CLEAR

Chemistry 1978 (results in mg/l unless otherwise noted) Station C28

	NH_3	TKN	NO_2	NO_3	T. P.	Tot. Org. C	Inorg. C	pH	Cond. (umhos/cm^3)
euphotic max.	0.014	0.51	0.003	0.200	0.023	6.2	20.4	8.20	205
zone min.	0.008	0.36	0.001	0.005	0.009	4.8	18.8	7.77	190
mean	0.011	0.43	0.002	0.035	0.015	5.6	19.7	8.00	199
bottom max.	0.030	0.51	0.003	0.200	0.022			8.22	205
waters min.	0.006	0.34	0.001	0.005	0.010			7.89	190
mean	0.016	0.45	0.002	0.040	0.016	5.4	19.7	8.01	200

	Ca	Mg	Hard.	Na	K	Alk.	Cl	SO_4	Colour (Hazen U.)	Turbidity (F.T.U.)
euphotic max.	34	3.25	97	2.8	0.95	88	4.9	13.5	19	1.5
zone min.	30	2.85	87	2.6	0.80	80	4.6	11.5	15	1.0
mean	32	3.05	92	2.7	0.87	84	4.8	12.7	17	1.2
bottom max.										
waters min.										
mean	33	3.05	95	2.8	0.88	86	4.8	12.5	12	1.0

Temperature/Dissolved Oxygen 1978

(^oC) (mg/l)

Annual Phosphorus Supply (Kg, %)

Land Runoff	____	____
Atmosphere	____	____
Shoreline Development	____	____

LAKE STONY (Lower Basin)
Station S27

Phytoplankton 1978
(% of total volume)

Cyanophyceae	16.8
Dinophyceae	1.3
Cryptophyceae	8.3
Chrysophyceae	6.7
Bacillariophyceae	62.1
Chlorophyceae	4.8

Common Species

Melosira granulata
Anabaena
Cryptomonas
Tabellaria
Synedra
Chrysosphaerella
Asterionella
Oocystic
Lyngbya

Zooplankton 1978
(% of total numbers)

Calanoida	3.2
Cyclopoida	28.2
Cladocera	65.5
Nauplii	3.1

Common Species

Benthos 1978

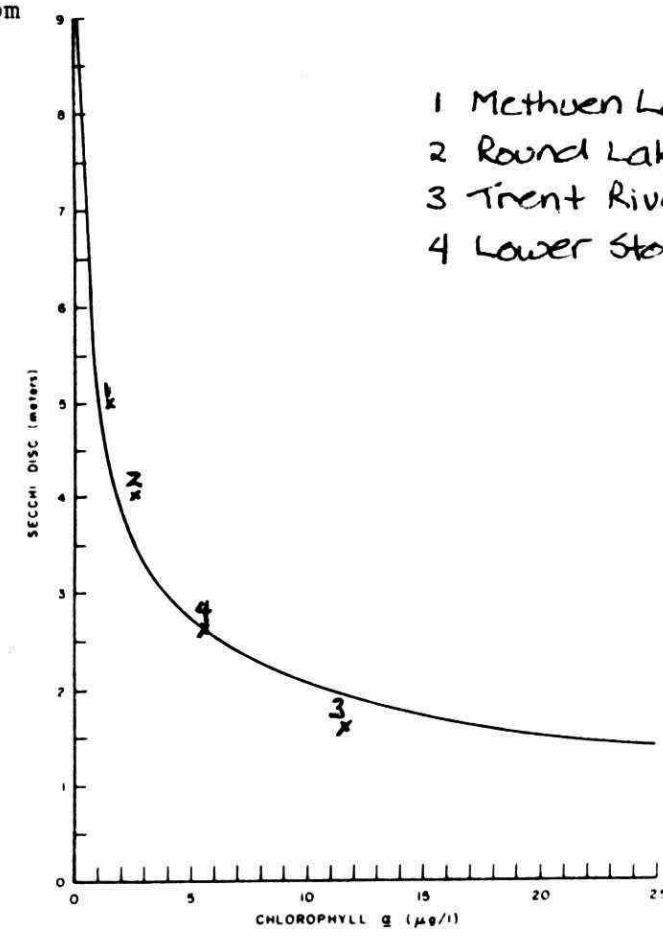
(% of total number)	early	late summer
Tubificidae	48.2	45.0
Chironomidae	38.5	0
Chaoboridae	13.0	55.0
Other	0.5	0
Total (Organisms/m^2	1062	2468

Common Species

unid. tubificidae
Chaoborus
Chironomus
Procladius

Aquatic Macrophytes for Clear & Stony from KLWMS

Potamogeton amplifolius
P. gramineus
P. nodosus
P. pectinatus
P. praelongus
P. richardsonii
P. robbinsii
P. zosteriformis
P. natans
P. vaseyi
Vallisneria americana
Elodea canadensis
Najas flexilis
Myriophyllum spp
Ceratophyllum demersum
Utricularia vulgaris
Ranunculus trichophyllus
Eleocharis acicularis
Sagittaria sp.
Chara spp
Nitella spp



1 Methuen Lake
2 Round Lake R4
3 Trent River T12
4 Lower Stony S27

LAKE STONY (Lower Basin)

Station S38

Phytoplankton 1978
(% of total volume)

Cyanophyceae	29.6
Dinophyceae	1.8
Cryptophyceae	1.4
Chrysophyceae	2.7
Bacillariophyceae	64.1
Chlorophyceae	0.3

Common Species

Stephanodiscus
Anabaena
Melosira granulata
Fragilaria
Asterionella

Zooplankton 1978
(% of total numbers)

Calanoida	17.7
Cyclopoida	31.8
Cladocera	45.2
Nauplii	5.3

Common Species

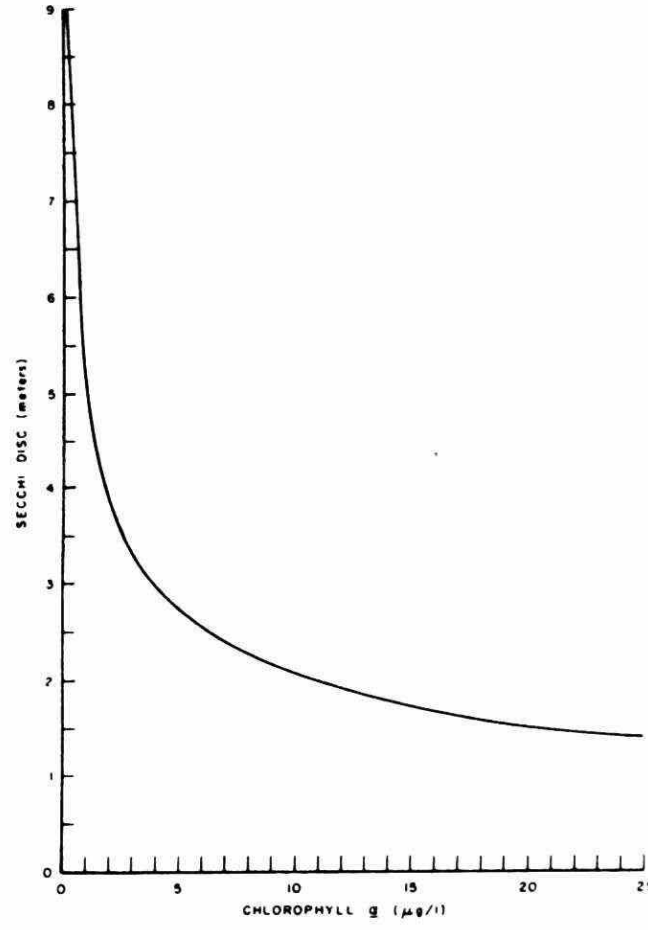
Diaphanosoma leuchtenbergianum
Daphnia galeata mendotae
Daphnia retrocurva
Bosmina sp.

Benthos 1978
(% of total number)

Tubificidae	____	____
Chironomidae	____	____
Chaoboridae	____	____
Other	____	____
Total (Organisms/m^2	____	____

Common Species

Aquatic Macrophytes



LAKE CLEAR

Station C28

Phytoplankton 1978
(% of total volume)

Cyanophyceae	26.5
Dinophyceae	1.3
Cryptophyceae	15.7
Chrysophyceae	5.9
Bacillariophyceae	48.1
Chlorophyceae	2.5

Common Species

Stephanodiscus
Anabaena
Cryptomonas
Aphanizomenon
Rhodomonas
Lyngbya
Melosira granulata

Zooplankton 1978
(% of total numbers)

Calanoida	15.4
Cyclopoida	25.0
Cladocera	51.7
Nauplii	7.8

Common Species

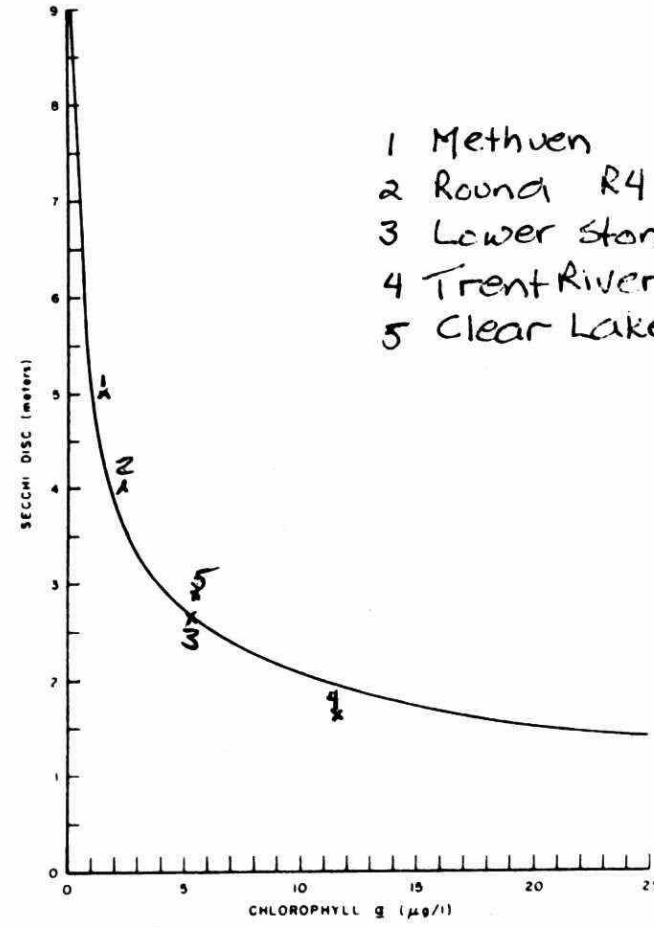
Benthos 1978

(% of total number)

Tubificidae	____	____
Chironomidae	____	____
Chaoboridae	____	____
Other	____	____
Total (Organisms/m^2	____	____

Common Species

Aquatic Macrophytes



1 Methuen
2 Round R4
3 Lower Stony S27
4 Trent River T12
5 Clear Lake

Ontario

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LAKE STONY (Upper Basin)

Township Dummer, Burleigh, Smith County Peterborough

Joint 7 Links Planning Board - Ministry of the Environment Survey

Morphometry

Surface Area (Ao)		Km^2
Volume (V)		$x10^6 m^3$
mean depth (Z)		m
maximum depth (Zm)		m
drainage basin (Ad)		Km^2

Geology of basin (%)

plutonic	
sedimentary	
volcanic	
limestone	

Basin cover (%)

forested	
cleared	

Shoreline development

permanent dwellings	0
cottages	664
cottage rental units	81
campground units	122
registered undeveloped	0

Historical Record for Station S105

Year	Discharge ($x10^6 m^3/yr$)	Tot. P. (ug/l)	Chlor. a (ug/l)	S.D. (m)	Phytopl. ($mm^3 l$)	Zoopl. (No./l)	A.H.O.D. ($mg/m^2/day$)
1970							
1971		20	2.5	5.0	-	-	580
1972		14	2.8	3.7	0.8		
1973							
1974							
1975							
1976		10	3.9	4.3	0.4		742 (843)*
1977							
1978(Sta.S105)		8	3.1	4.6	0.47	9	496 (509)
1978(Sta. S60)		10	3.0	4.5	0.53	9	

* based on only 6 sample runs.

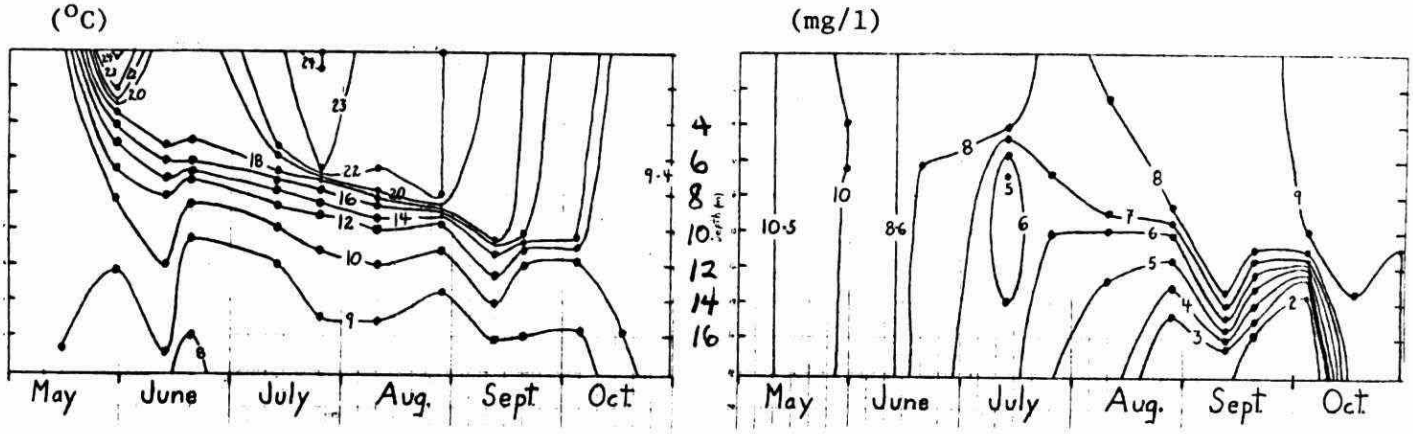
LAKE STONY (Upper Basin)

Chemistry 1978 (results in mg/l unless otherwise noted) Station S60

	NH_3	TKN	NO_2	NO_3	T. P.	Tot. Org. C	Inorg. C	pH	Cond. (umhos/cm^3)
euphotic max.	0.016	0.68	0.003	0.120	0.016	5.9	15.6	8.07	170
zone min.	0.006	0.33	0.001	0.005	0.007	5.1	14.6	7.53	150
mean	0.010	0.40	0.002	0.040	0.010	5.5	15.2	7.78	162
bottom max.	0.020	0.45	0.003	0.245	0.009	5.5	18.4	8.21	165
waters min.	0.006	0.25	0.001	0.050	0.006	4.7	14.6	7.09	160
mean	0.010	0.33	0.002	0.164	0.008	5.1	16.2	7.49	161

	Ca	Mg	Hard.	Na	K	Alk.	Cl	SO_4	Colour (Hazen U.)	Turbidity (F.T.U.)
euphotic max.	27	2.25	76	2.2	1.00	67	3.3	12.0	21	1.0
zone min.	24	2.15	69	2.0	0.80	64	2.9	11.0	10	0.6
mean	25	2.20	72	2.1	0.90	66	3.1	11.5	17	0.8
bottom max.	27	2.25	76	2.0	0.95	68	3.1	12.0	25	1.6
waters min.	24	2.15	69	1.9	0.85	65	2.8	11.0	22	0.9
mean	26	2.18	73	2.0	0.90	66	2.9	11.7	24	1.1

Temperature/Dissolved Oxygen 1978 Station S60



Annual Phosphorus Supply (Kg, %)

Land Runoff	____	____
Atmosphere	____	____
Shoreline Development	____	____

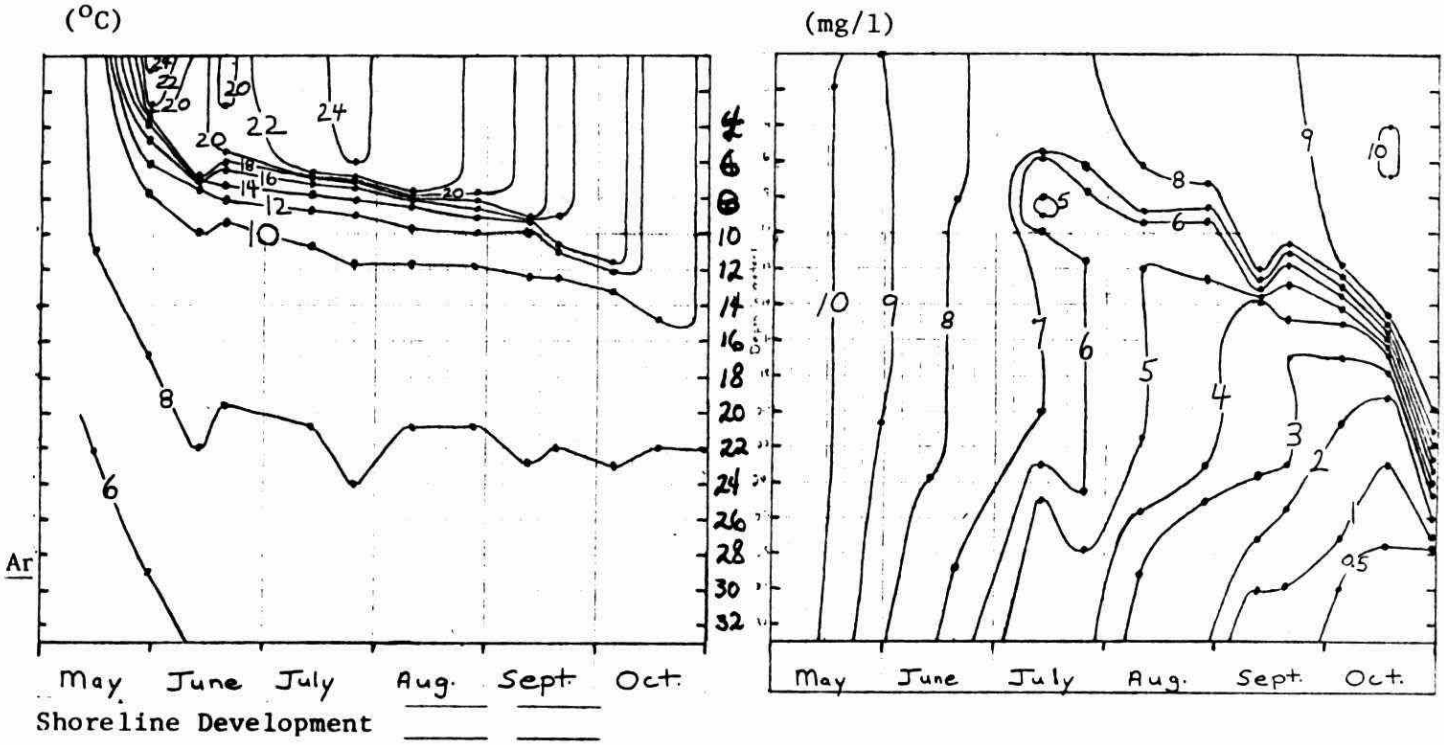
LAKE STONY (Upper Basin)

Chemistry 1978 (results in mg/l unless otherwise noted) Station S105

	NH_3	TKN	NO_2	NO_3	T. P.	Tot. Org. C	Inorg. C	pH	Cond. (umhos/cm^3)
euphotic max.	0.026	0.45	0.003	0.080	0.012	5.6	15.4	8.05	165
zone min.	0.006	0.26	0.001	0.005	0.003	5.0	14.8	7.63	147
mean	0.014	0.36	0.002	0.029	0.008	5.4	15.0	7.81	158
bottom max.	0.054	0.50	0.008	0.280	0.016	5.5	19.2	7.45	170
waters min.	0.004	0.24	0.001	0.140	0.004	4.9	15.8	6.72	160
mean	0.016	0.32	0.003	0.219	0.008	5.1	18.1	7.11	166

	Ca	Mg	Hard.	Na	K	Alk.	Cl	SO_4	Colour (Hazen U.)	Turbidity (F.T.U.)
euphotic max.	27.0	2.25	76	2.0	0.95	67	3.1	12.0	20	1.7
zone min.	24.0	2.10	69	2.0	0.75	63	3.0	5.0	14	0.6
mean	25.3	2.18	72	2.0	0.85	65	3.1	9.5	18	1.1
bottom max.	27.0	2.95	80	2.0	1.00	71	3.0	11.5	53	1.6
waters min.	27.0	2.30	77	1.9	0.85	68	2.8	7.0	20	0.95
mean	27.0	2.53	78	2.0	0.92	69	2.9	9.8	34	1.4

Temperature/Dissolved Oxygen 1978 Station S105



Shoreline Development

LAKE STONY (Upper Basin)

Phytoplankton 1978

(% of total volume)

	S105	S60
Cyanophyceae	13.3	10.4
Dinophyceae	11.0	8.0
Cryptophyceae	17.5	22.0
Chrysophyceae	48.2	39.6
Bacillariophyceae	6.3	16.8
Chlorophyceae	3.6	3.8

Common Species

Chrysosphaerella
Dinobryon
Cryptomonas
Oscillatoria
Anabaena
Stephanodiscus
Rhizosolenia

Zooplankton 1978

(% of total numbers)

	S105	S60
Calanoida	41.5	33.4
Cyclopoida	26.9	32.4
Cladocera	28.2	28.4
Nauplii	3.4	5.8

Common Species

Limnocalanus macrurus
Diaptomus oregonensis
Diaphanosoma leuchtenbergianum
Daphnia galeata mendotae
Mesocyclops edax
Cyclops scutifer

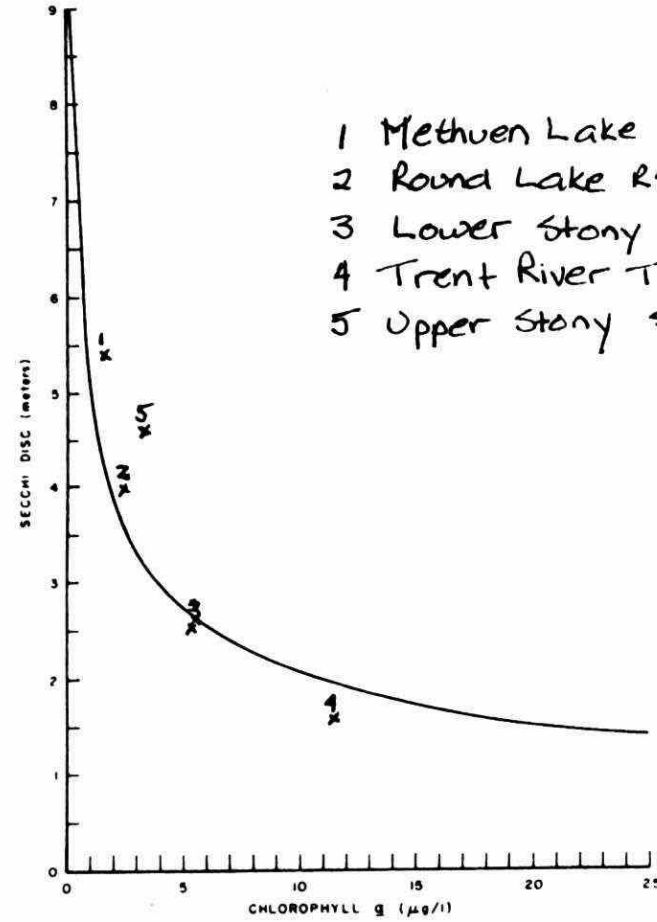
Benthos 1978

(% of total number)	early summer	late summer
Tubificidae	0	31.0
Chironomidae	62.6	65.9
Chaoboridae	18.9	3.1
Other	18.5	0
Total (Organisms/m^2)	3584	2468

Common Species

Chironomus
Chaoborus
Procladius
Ponteporeia affinis
Sphaeridae

Aquatic Macrophytes



1 Methuen Lake
2 Round Lake R4
3 Lower Stony S27
4 Trent River T12
5 Upper Stony S105

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Ministry of the Environment

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TRENT RIVER

The Trent River was sampled at 6 locations immediately upstream and downstream of the Village of Hastings where Rice Lake discharges.

The Village uses the river as its source of domestic water supply. Water is taken at approximately the location of Station T8. The Village sewage treatment plant discharges to the river near Station T9 downstream of the control dam operated by Parks Canada.

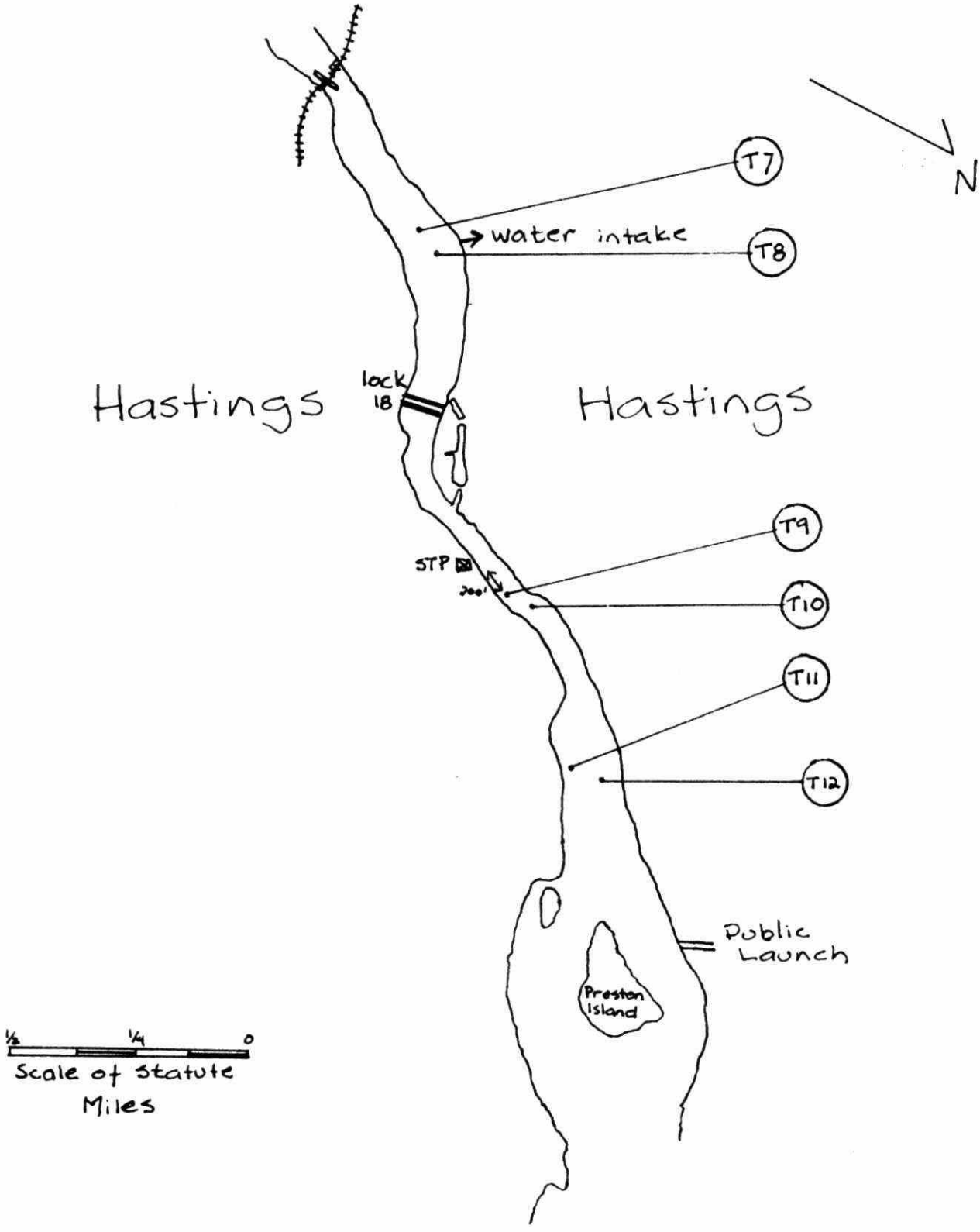
The Trent River had hard alkaline water with a moderately high amount of apparent colour. Water Quality as indicated by Secchi disc was poor with an average value of 1.3 metres. Relatively high inorganic turbidity and colour probably depressed the overall water clarity apart from phytoplankton.

Total phosphorus concentration in the river water was high and sufficient to promote nuisance growths of phytoplankton at all stations.

Phytoplankton growths in the River were a nuisance to densities both upstream and downstream of Hastings. Blooms with unsightly scums and the "pea soup" colouring of the water column were noted during the latter part of the summer. The dominant groups present were Bacillariophyceae and Cyanophyceae. The most common species were the same forms common in the Bay of Quinte, a very enriched water body.

In summary, the river at Hastings was a very enriched system with poor water quality. The River was considered eutrophic. Because of the large phosphorus inputs from upstream sources, the River was considered least sensitive of all the water bodies in the Planning Area to further unrestricted shoreline development. Many people may not enjoy swimming in the Trent River because of aesthetic problems caused by the heavy phytoplankton growths.

Trent River Sampling Stations
1978



LAKE TRENT RIVER

Chemistry 1978 (results in mg/l unless otherwise noted) Station T7

		NH_3	TKN	NO_2	NO_3	T. P.	Tot. Org. C	Inorg. C	pH	Cond. (umhos/cm^3)
euphotic zone	max.	0.232	1.15	0.004	0.015	0.053	6.7	24.1	8.53	245
	min.	0.006	0.39	0.001	0.005	0.013	5.2	21.4	7.67	209
	mean	0.044	0.67	0.002	0.007	0.032	5.9	23.3	8.09	228
bottom waters	max.									
	min.									
	mean									

		Ca	Mg	Hard.	Na	K	Alk.	Cl	SO_4	Colour (Hazen U.)	Turbidity (F.T.U.)
euphotic zone	max.	40	4.00	114	3.9	1.10	101	6.8	14.0	23	4.3
	min.	32	3.35	96	3.3	0.95	91	5.6	12.0	21	1.1
	mean	36	3.80	106	3.7	1.05	97	6.2	13.2	22	2.4
bottom waters	max.										
	min.										
	mean										

Temperature/Dissolved Oxygen 1978 Station T7A at 1 m

	(^oC)	(mg/l)
May 29, 1978	23.8	9.8
June 6, 1978	20.8	8.2
July 14, 1978	23.0	7.2
August 11, 1978	23.0	7.9
September 8, 1978	20.4	9.0
October 5, 1978	14.8	9.7
October 30, 1978	8.4	11.5

Annual Phosphorus Supply (Kg, %)

Land Runoff	_____	_____
Atmosphere	_____	_____
Shoreline Development	_____	_____

LAKE TRENT RIVER

Chemistry 1978 (results in mg/l unless otherwise noted) T8

		NH_3	TKN	NO_2	NO_3	T. P.	Tot. Org. C	Inorg. C	pH	Cond. (umhos/cm^3)
euphotic zone	max.	0.224	1.23	0.004	0.010	0.054	6.6	24.4	8.53	245
	min.	0.005	0.37	0.001	0.005	0.012	5.2	21.2	7.71	205
	mean	0.040	0.67	0.002	0.006	0.033	5.9	23.1	8.11	228
bottom waters	max.									
	min.									
	mean									

		Ca	Mg	Hard.	Na	K	Alk.	Cl	SO_4	Colour (Hazen U.)	Turbidity (F.T.U.)
euphotic zone	max.	40	3.95	113	3.9	1.05	102	6.8	14.0	32	4.7
	min.	31	3.30	93	3.3	0.95	91	5.7	12.0	22	0.9
	mean	36	3.68	105	3.7	1.02	98	6.3	13.2	25	2.9
bottom waters	max.										
	min.										
	mean										

Temperature/Dissolved Oxygen 1978 Station T8 at 1m

	(^oC)	(mg/l)
May 29, 1978	23.7	9.8
June 9, 1978	21.0	8.3
July 14, 1978	23.1	7.2
August 11, 1978	23.5	8.4
September 8, 1978	20.1	9.0
October 5, 1978	14.8	9.3
October 30, 1978	8.6	11.5

Annual Phosphorus Supply (Kg, %)

Land Runoff	_____	_____
Atmosphere	_____	_____
Shoreline Development	_____	_____

LAKE TRENT RIVER

Chemistry 1978 (results in mg/l unless otherwise noted) Station T9

		NH_3	TKN	NO_2	NO_3	T. P.	Tot. Org. C	Inorg. C	pH	Cond. (umhos/cm^3)
euphotic zone	max.	0.210	1.14	0.005	0.060	0.066	6.6	24.4	8.56	245
	min.	0.008	0.35	0.001	0.005	0.015	5.2	21.0	7.86	205
	mean	0.039	0.67	0.003	0.016	0.041	5.8	23.1	8.13	228
bottom waters	max.									
	min.									
	mean									

		Ca	Mg	Hard.	Na	K	Alk.	Cl	SO_4	Colour (Hazen U.)	Turbidity (F.T.U.)
euphotic zone	max.	39	3.95	111	4.2	1.05	101	6.85	14.0	32	4.6
	min.	32	3.35	96	3.7	0.95	91	6.00	12.0	23	1.2
	mean	36	3.75	105	3.9	1.02	98	6.60	13.3	26	2.8
bottom waters	max.										
	min.										
	mean										

Temperature/Dissolved Oxygen 1978 Station T9 at 1 m

	(^oC)	(mg/l)
May 29, 1978	24.1	8.6
June 9, 1978	21.1	8.4
July 14, 1978	23.1	7.7
August 11, 1978	23.5	8.2
September 8, 1978	20.4	9.4
October 5, 1978	15.0	9.9
October 30, 1978	8.6	11.7

Annual Phosphorus Supply (Kg, %)

Land Runoff	_____	_____
Atmosphere	_____	_____
Shoreline Development	_____	_____

LAKE TRENT RIVER

Chemistry 1978 (results in mg/l unless otherwise noted) Station T10

		NH_3	TKN	NO_2	NO_3	T. P.	Tot. Org. C	Inorg. C	pH	Cond. (umhos/cm^3)
euphotic zone	max.	0.232	1.18	0.64	0.010	0.058	6.3	24.4	8.55	245
	min.	0.006	0.36	0.001	0.005	0.011	5.0	21.0	7.87	205
	mean	0.042	0.68	0.002	0.006	0.035	5.9	23.4	8.12	228
bottom waters	max.									
	min.									
	mean									

		Ca	Mg	Hard.	Na	K	Alk.	Cl	SO_4	Colour (Hazen U.)	Turbidity (F.T.U.)
euphotic zone	max.	40	3.90	113	4.0	1.1	101	6.8	14.0	6.3	4.4
	min.	32	3.25	96	3.3	0.95	90	5.7	12.0	5.0	1.1
	mean	36	3.68	106	3.8	1.02	97	6.3	13.2	5.7	2.6
bottom waters	max.										
	min.										
	mean										

Temperature/Dissolved Oxygen 1978 Station T10 at 1 m

	(^oC)	(mg/l)
May 29, 1978	24.1	8.6
June 9, 1978	21.1	8.5
July 14, 1978	23.1	7.7
August 11, 1978	24.0	8.1
September 8, 1978	20.4	9.2
October 5, 1978	15.0	10.3
October 30, 1978	8.5	11.7

Annual Phosphorus Supply (Kg, %)

Land Runoff	_____	_____
Atmosphere	_____	_____
Shoreline Development	_____	_____

LAKE TRENT RIVER

Chemistry 1978 (results in mg/l unless otherwise noted) Station T11

	NH_3	TKN	NO_2	NO_3	T. P.	Tot. Org. C	Inorg. C	pH	Cond. (umhos/cm^3)
euphotic max.	0.236	1.14	0.004	0.015	0.053	6.3	24.4	8.53	245
zone min.	0.006	0.38	0.001	0.005	0.015	5.1	20.8	7.81	205
mean	0.043	0.69	0.002	0.008	0.034	5.8	23.0	8.11	229
bottom max.									
waters min.									
mean									

	Ca	Mg	Hard.	Na	K	Alk.	Cl	SO_4	Colour (Hazen U.)	Turbidity (F.T.U.)
euphotic max.	40	3.95	113	3.9	1.05	101	6.8	13.5	30	4.3
zone min.	32	3.3	96	3.4	0.95	91	5.7	12.0	22	1.0
mean	36	3.7	1.06	3.7	1.02	97	6.3	13.0	25	2.6
bottom max.										
waters min.										
mean										

Temperature/Dissolved Oxygen 1978 Station T11 at 1 m

	(^oC)	(mg/l)
May 29, 1978	23.9	8.8
June 9, 1978	20.9	8.3
July 14, 1978	23.2	7.7
August 11, 1978	23.5	7.8
September 8, 1978	20.4	9.1
October 5, 1978	15.0	10.2
October 30, 1978	8.4	11.7

Annual Phosphorus Supply (Kg, %)

Land Runoff	_____	_____
Atmosphere	_____	_____
Shoreline Development	_____	_____

LAKE TRENT RIVER

Chemistry 1978 (results in mg/l unless otherwise noted) Station T 12

		NH_3	TKN	NO_2	NO_3	T. P.	Tot. Org. C	Inorg. C	pH	Cond. (umhos/cm^3)
euphotic zone	max.	0.214	1.14	0.004	0.025	0.054	6.3	24.4	8.58	245
	min.	0.004	0.35	0.001	0.005	0.014	5.2	21.2	7.83	210
	mean	0.040	0.67	0.003	0.012	0.035	5.8	23.1	8.12	229
bottom waters	max.									
	min.									
	mean									

		Ca	Mg	Hard.	Na	K	Alk.	Cl	SO_4	Colour (Hazen U.)	Turbidity (F.T.U.)
euphotic zone	max.	40	3.95	113	4.3	1.05	103	7.2	14.0	27	4.4
	min.	32	3.30	96	3.5	0.95	91	5.7	12.0	20	1.1
	mean	36	3.71	106	4.0	1.02	98	6.6	13.2	24	2.7
bottom waters	max.										
	min.										
	mean										

Temperature/Dissolved Oxygen 1978 Station T12 at 1 m

	(^oC)	(mg/l)
May 29, 1978	24.0	8.8
June 9, 1978	21.1	8.4
July 14, 1978	23.5	7.6
August 11, 1978	23.5	8.0
September 8, 1978	20.4	9.1
October 5, 1978	15.0	10.9
October 30, 1978	8.5	11.7

Annual Phosphorus Supply (Kg, %)

Land Runoff	_____	_____
Atmosphere	_____	_____
Shoreline Development	_____	_____

LAKE TRENT RIVER

Phytoplankton 1978
(% of total volume)

	T7	T11
Cyanophyceae	42.9	46.0
Dinophyceae	2.6	1.2
Cryptophyceae	1.7	1.8
Chrysophyceae	0.9	1.3
Bacillariophyceae	50.7	49.0
Chlorophyceae	1.2	0.6
Total (mm^3/l)	6.13	8.13

Common Species

Melosira
Anabaena
Aphanizomenon
Oscillatoria
Lyngbya

Zooplankton 1978
(% of total numbers)

Calanoida _____
Cyclopoida _____
Cladocera _____
Nauplii _____

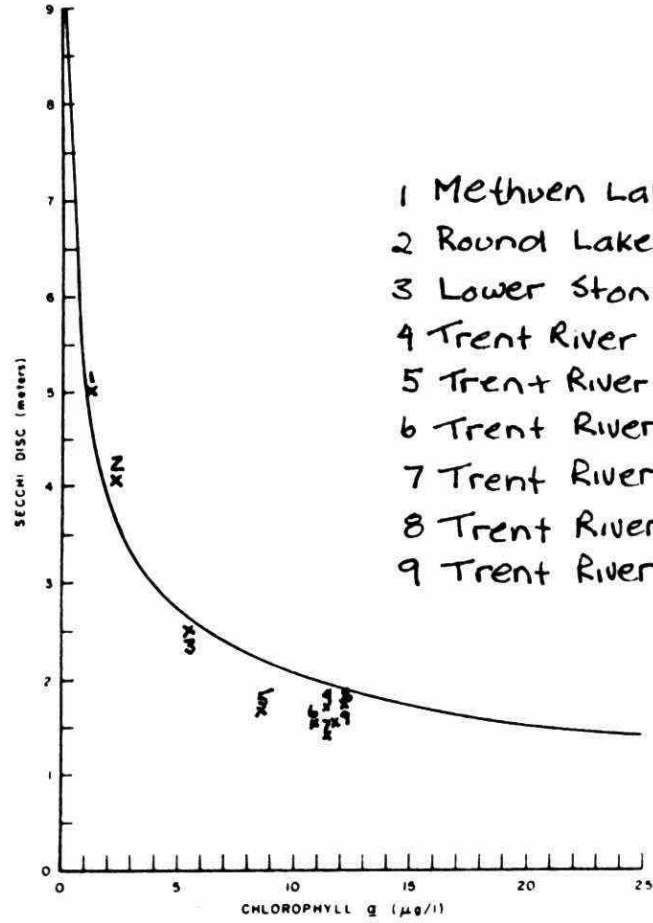
Common Species

Benthos 1978
(% of total number)

Tubificidae _____ _____
Chironomidae _____ _____
Chaoboridae _____ _____
Other _____ _____
Total (Organisms/m^2 _____ _____

Common Species

Aquatic Macrophytes



1 Methven Lake
2 Round Lake R4
3 Lower Stony S27
4 Trent River T12
5 Trent River T7A
6 Trent River T8
7 Trent River T9
8 Trent River T10
9 Trent River T11

Ontario

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EAST AND WEST TWIN LAKES

East and West Twin Lakes are located approximately 22 Km north of the Village of Havelock in Methuen Township. East Twin Lake is separated from West Twin Lake by County Road No. 46. Flow from this lake finds its way to West Twin Lake which also receives flow from an unnamed tributary. West Twin Lake discharges to Otter Creek which joins the North River just upstream of Belmont Lake.

EAST TWIN LAKE

East Twin Lake is a very small, shallow lake with two permanent dwellings, 6 cottages and 7 motel units along its shoreline. The lake has soft, slightly alkaline water with relatively low colour. Water clarity was moderately good with Secchi disc frequently seen on the bottom at about 5 metres.

The temperature and the dissolved oxygen concentration were uniform through the water column at Station T3. Total phosphorus concentration in the euphotic zone was low and indicated unenriched or oligotrophic conditions.

The phytoplankton was dominated by the dinophyceae with Chysophyceae next most dominant. These groups are usually dominant in unenriched waters. The low phytoplankton densities indicated oligotrophic conditions.

The zooplankton community was dominated by Cladocera and Calanoida. The size of the lake basin may have affected density and composition more than trophic conditions.

WEST TWIN

West Twin Lake had 3 permanent residences and 72 cottages on the shoreline during 1978. The overall flushing rate was moderate ($1.46\ yr^{-1}$).

Thermal stratification was evident at Station T4 during the entire sampling period. The lake had soft acidic water with moderately high apparent colour. Water clarity as indicated by Secchi disc was moderately good and may have been somewhat depressed because of dissolved colour in the water column. Based on S.D. alone, West Twin Lake was considered moderately enriched or mesotrophic.

Thermal stratification was evident at Station T4 during the entire sampling period. The lake may not have been completely mixed from surface to bottom after ice-out in the spring.

Dissolved oxygen distribution was clinograde (gradually decreasing within the bottom waters with depth). The seasonal distribution did not change significantly during the sampling period. The minimum D.O. concentration in the bottom waters was 0.0 mg/l. The decrease in D.O. with depth was probably due to the decomposition of organic matter and the sediment oxygen demand.

The meant Total Phosphorus concentration in the euphotic zone was low during the sampling period indicating unenriched or oligotrophic conditions. There was a definite accumulation of nutrients in the bottom waters of the lake. Although the lake water quality status was good, further aggravation of the dissolved oxygen depletion in the bottom waters could result in a larger accumulation of nutrients with undesireable water quality effects.

Phytoplankton density was moderately low with a dominance of Chrysophyceae. This group is normally associated with unenriched waters. Based on phytoplankton density and composition, the lake was considered unenriched or oligotrophic.

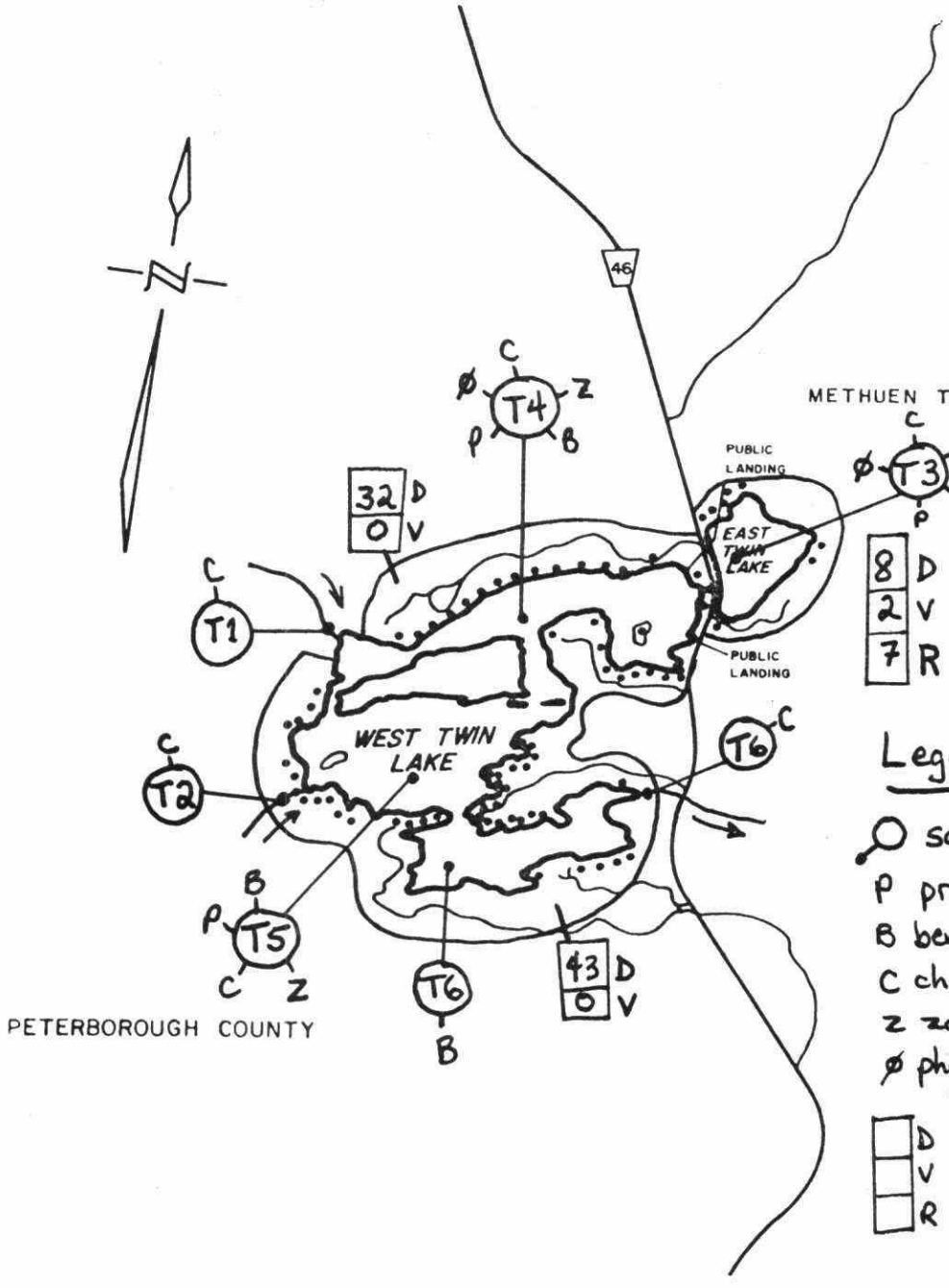
The crustacean zooplankton community was dominated by Cladocera. This group generally dominates in enriched conditions. The relatively low density and composition of zooplankton indicated that the lake was moderately enriched or mesotrophic.

Relatively low densities of benthic invertebrates were noted in the deep lake sediments. Chaoborus the most common form, is well adjusted to living in low dissolved oxygen conditions. Based on density of benthos, the lake was considered ligotrophic.

In summary, East and West Twin Lakes had relatively good water quality during 1978.

Based on the general water quality, the lakes were considered unenriched or oligotrophic but bordering on mesotrophic conditions. East Twin Lake, because of its small surface area and shallow nature, was considered sensitive to further unrestricted shoreline development. West Twin Lake was also considered sensitive to further unrestricted soreline development phosphorus input.

East and West Twin Lakes
Station Locations and Development 1978



Legend

- sampling station
- P profile of temp. & D.O.
- B benthic sample
- C chemical sample
- Z zooplankton sample
- Ø phytoplankton sample

- D dwellings
- V registered vacant lots
- R motel units

FEET 2000 1000 0 1000 2000 3000 4000 5000 FEET

METRES 600 300 0 300 600 900 METRES

Ontario

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LAKE EAST TWIN

Township County

Joint 7 Links Planning Board - Ministry of the Environment Survey

Morphometry

Surface Area (Ao)	0.063	Km^2
Volume (V)		$x10^6 m^3$
mean depth (Z)		m
maximum depth (Zm)		m
drainage basin (Ad)		Km^2

Geology of basin (%)

plutonic	
sedimentary	
volcanic	
limestone	

Basin cover (%)

forested	
cleared	

Shoreline development

permanent dwellings	2
cottages	6
cottage rental units	7
campground units	0
registered undeveloped	2

Historical Record

Year	Discharge ($x10^6 m^3/yr$)	Tot. P. (ug/l)	Chlor. a (ug/l)	S.D. (m)	Phytopl. ($mm^3 l$)	Zoopl. (No./l)	A.H.O.D. ($mg/m^2/day$)
1970							
1971							
1972							
1973							
1974							
1975							
1976							
1977							
1978		6	1.3	4.3 (btm)	0.53	31	

LAKE EAST TWIN

Chemistry 1978 (results in mg/l unless otherwise noted) Station T3

		NH_3	TKN	NO_2	NO_3	T. P.	Tot. Org. C	Inorg. C	pH	Cond. (umhos/cm^3)
euphotic zone	max.	0.084	0.53	0.002	0.040	0.010	5.2	4.8	7.58	93
	min.	0.006	0.29	0.001	0.005	0.001	3.6	4.2	7.05	85
	mean	0.028	0.40	0.001	0.017	0.006	4.6	4.5	7.32	90
bottom waters	max.									
	min.									
	mean									

euphotic zone usually reached bottom waters

		Ca	Mg	Hard.	Na	K	Alk.	Cl	SO_4	Colour (Hazen U.)	Turbidity (F.T.U.)
euphotic zone	max.	10.2	0.95	29	5.3	1.00	25	7.7	8.0	15	1.1
	min.	9.6	0.85	27	4.7	0.90	21	7.1	7.5	10	0.5
	mean	10.0	0.90	28	5.0	0.95	23	7.3	7.7	12	0.8
bottom waters	max.										
	min.										
	mean										

euphotic zone usually reached bottom waters

Temperature/Dissolved Oxygen 1978

(^oC) (mg/l)

non-stratified

at or near saturation through sampling period.

Annual Phosphorus Supply (Kg, %)

Land Runoff	_____	_____
Atmosphere	_____	_____
Shoreline Development	_____	_____

LAKE EAST TWIN

Phytoplankton 1978
(% of total volume)

Cyanophyceae	10.9
Dinophyceae	44.7
Cryptophyceae	9.0
Chrysophyceae	26.6
Bacillariophyceae	0.9
Chlorophyceae	7.9

Common Species

unid. dinophyceae
Oscillatoria
Dinobryon
Chrysosphaerella
Cryptomonas

Zooplankton 1978
(% of total numbers)

Calanoida	33.2
Cyclopoida	23.2
Cladocera	39.2
Nauplii	4.3

Common Species

Daphnia retrocurva
Holopedium gibberum
Bosmina sp.
Epischura lacustris
Diaptomus oregonensis
Mesocyclops edax

Benthos 1978

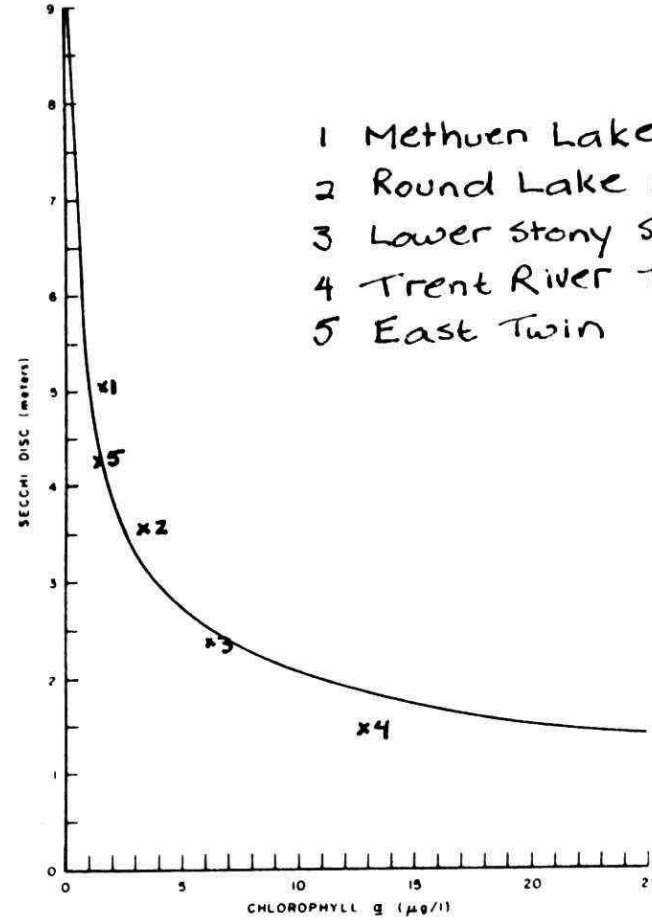
(% of total number)	early summer	late summer
Tubificidae	0	0
Chironomidae	50	95.8
Chaoboridae	0	0
Other	50	4.2
Total (Organisms/m^2	76	7731

Common Species

unid. diamesinae
unid. chironomini
unid. tanytarsini
Procladius
Polypedelium

Aquatic Macrophytes

Potamogeton amplifolius
P. epihydrus
P. gramineus
P. natans
P. pusillus
Eleocharis robbinsii
Scirpus subterminalis
Eriocaulon septangulare
Brasenia schreberi
Nuphar variegatum
Nymphea odorata
Utricularia vulgaris



Ontario

Ministry of the Environment

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LAKE WEST TWIN

Township Methuen County Peterborough

Joint 7 Links Planning Board - Ministry of the Environment Survey

Morphometry

Surface Area (Ao)	0.41	Km^2
Volume (V)	1.38	$x10^6m^3$
mean depth (Z)	3.4	m
maximum depth (Zm)	12.2	m
drainage basin (Ad)	5.00	Km^2

Geology of basin (%)

plutonic	90
sedimentary	10
volcanic	0
limestone	0

Basin cover (%)

forested	100
cleared	

Shoreline development

permanent dwellings	3
cottages	72
cottage rental units	0
campground units	0
registered undeveloped	0

Historical Record

Year	Discharge ($x10^6m^3/yr$)	Tot. P. (ug/l)	Chlor. a (ug/l)	S.D. (m)	Phytopl. (mm^3l)	Zoopl. (No./l)	A.H.O.D. ($mg/m^2/day$)
1970							
1971							
1972							
1973							
1974							
1975							
1976							
1977							
1978	2.01	7	2.8	4.0	0.22	15	

LAKE WEST TWIN

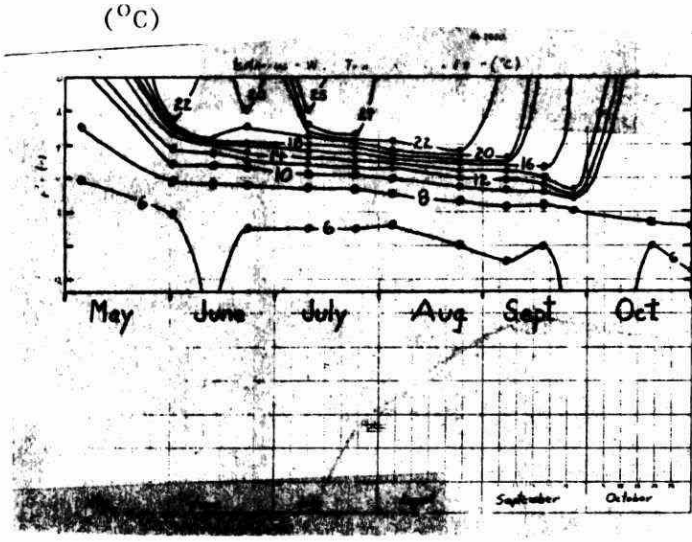
Chemistry 1978 (results in mg/l unless otherwise noted) Station T4

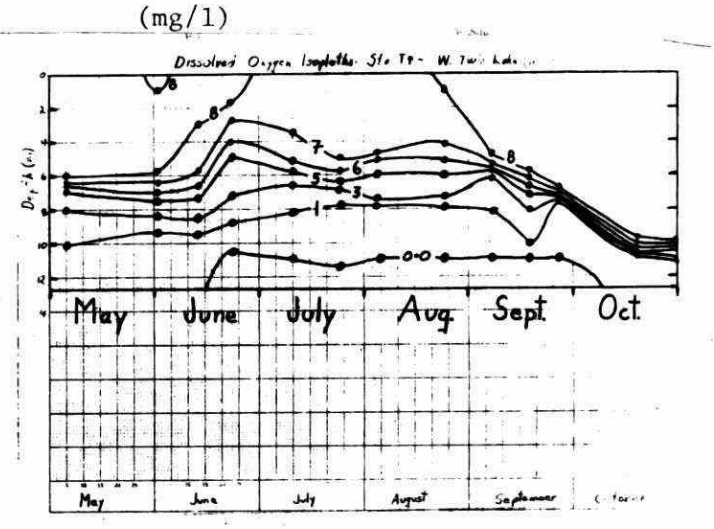
	NH_3	TKN	NO_2	NO_3	T. P.	Tot. Org. C	Inorg. C	pH	Cond. (umhos/cm^3)
euphotic max.	0.114	0.49	0.003	0.110	0.010	4.8	4.0	6.79	58
zone min.	0.048	0.18	0.001	0.005	0.004	4.0	2.8	6.38	56
mean	0.075	0.36	0.002	0.039	0.007	4.5	3.6	6.54	57
bottom max.	0.920	1.38	0.005	0.070	0.020	6.3	10.6	6.31	96
waters min.	0.340	0.67	0.001	0.005	0.009	4.4	7.6	6.18	75
mean	0.652	1.01	0.002	0.014	0.014	5.3	9.5	6.25	82

	Ca	Mg	Hard.	Na	K	Alk.	Cl	SO_4	Colour (Hazen U.)	Turbidity (F.T.U.)
euphotic max.	6.6	0.85	20	2.4	0.70	16	3.5	6.0	27	1.5
zone min.	6.4	0.75	19	2.3	0.70	13	3.2	5.5	24	1.0
mean	6.5	0.82	19	2.4	0.70	15	3.4	5.8	25	1.2
bottom max.	9.2	1.05	27	3.2	0.90	31	4.8	7.5	354	6.0
waters min.	8.4	0.95	25	3.0	0.85	20	4.4	5.0	60	3.1
mean	8.8	1.00	26	3.1	0.88	27	4.6	6.2	202	5.0

Temperature/Dissolved Oxygen 1978 Station T4

(^oC) (mg/l)





Annual Phosphorus Supply (Kg, %)

Land Runoff	27	32
Atmosphere	20	23
Shoreline Development	38	45

LAKE WEST TWIN

Phytoplankton 1978
(% of total volume)

Cyanophyceae	7.1
Dinophyceae	4.9
Cryptophyceae	7.1
Chrysophyceae	66.1
Bacillariophyceae	5.8
Chlorophyceae	8.9

Common Species

Chrysosphaerella
unid. chrysomonads
Synura
Stephanodiscus
Oocystis

Zooplankton 1978
(% of total numbers)

Calanoida	15.1
Cyclopoida	35.0
Cladocera	48.4
Nauplii	1.4

Common Species

Diaphanosoma leuchtenbergianum
Daphnia retrocurva
Holopedium gibberum
Mesocyclops edax
Cyclops scutifer
Diaptomus oregonensis

Benthos 1978
(% of total number)

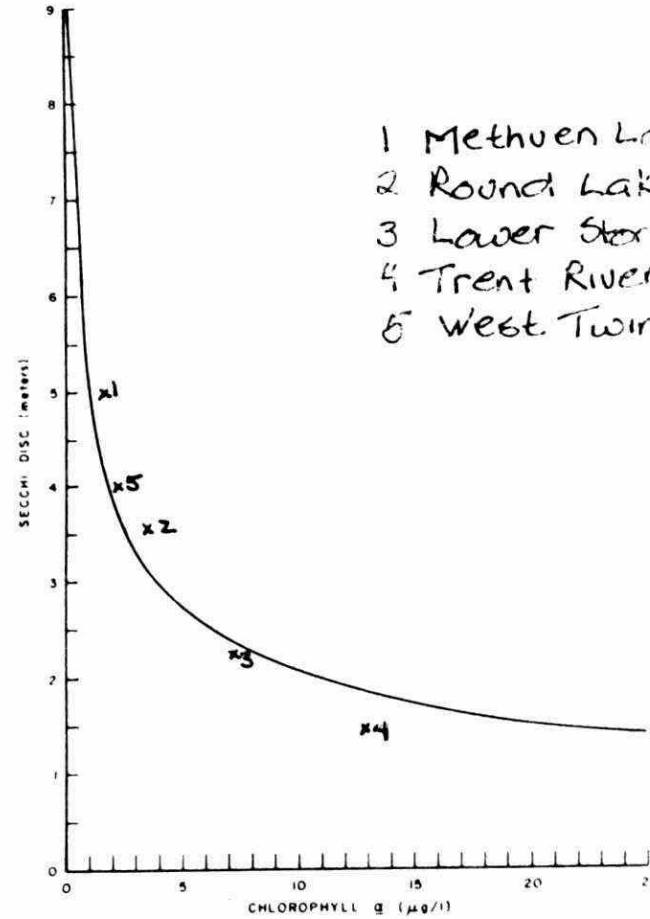
Tubificidae	0	0
Chironomidae	14.2	0
Chaoboridae	85.8	100
Other	0	0
Total (Organisms/m^2	134	1129

Common Species

Chaoborus
unid. chironomini

Aquatic Macrophytes

Nitella sp
Potamogeton amplifolius
P. epihydrus
P. gramineus
P. natans
P. pusillus
P. robbinsii
P. zosteriformis
Najas flexilis
Sagittaria sp.
Elodea canadensis
Vallisneria americana
Eleocharis robbinsii
Scirpus subterminalis
Eriocaulon septangulare
Pontederia cordata
Polygonum amphibium
Nuphar variegatum
Nymphea odorata
Ranunculus sp.
Amoracia aquatica
Myriophyllum heterophyllum
Utricularia gibba
U. vulgaris



1 Methuen Lake
2 Round Lake R4
3 Lower Storey Sâ7
4 Trent River T12
5 West Twin

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LIST OF ABBREVIATIONS USED IN THE REPORTS

Tot. P. or T.P.	Total phosphorus concentration
Chlor. q	chlorophyll a concentration
S.D.	Secchi disc
Phytopl.	phytoplankton
zoopl.	zooplankton
A.H.O.D.	areal hypolimnetic oxygen demand
NH_3	ammonia concentration
TKN	total Kjeldahl Nitrogen concentration
NO_2	nitrite concentration
NO_3	nitrate concentration
Tot. Org. C	total organic carbon concentration
Inorg. C	inorganic carbon concentration
Cond.	conductivity
Ca	calcium concentration
Mg	magnesium concentration
Hard.	hardness in mg/l as $CaCo_3$
Na	sodium concentration
K	potasium concentration
Alk.	alkalinity in mg/l as $CaCo_3$
Cl	chloride concentration
SO_4	sulphate concentration